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Electrical Review

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Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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Contents:

	PAGE
The I.M.E.A. Convention	975
Electrical Refrigeration	976
The Centenary of the Institution of Civil Engineers	976
The Electrical Trade Position	976
The Electrical Trades Benevolent Institution	976
The I.M.E.A. in the West Country.—I (*illus.*)	977
Bath Corporation's Electricity Works	978
Stothert & Pitt, Ltd.	978
J. S. Fry & Sons, Ltd.	979
Mawdsley's, Ltd.	980
Petters, Ltd.	989
Westinghouse Brake and Saxby Signal Co., Ltd.	989
The West Ham Electricity Undertaking	990
The Bristol Corporation Electricity Undertaking (*illus.*)	991
Directional Wireless Marine Navigation, by R. L. Smith-Rose	994
Legal	995
Reviews	996
Business and Industrial Notes	997
Lighting and Power Notes	1001
Tramway and Railway Notes	1002
Telegraph and Telephone Notes	1003
Radio Notes	1003
Contract Information	1004
Forthcoming Events	1005
Institution Notes	1007
Notes	1005
Our Personal Column	1008
Financial Section—	
New Companies Registered	1008
Official Returns of Electrical Companies	1009
City Notes	1010
Stocks and Shares	1011
Pulverised-Fuel Developments in the United States, by L. M. Jockel	1013
Tendencies in the Electrical Trade	1015
Australian Imports and Exports	1016
The Lighting of a Modern Liner (*illus.*)	1017
A Special Lighting Installation (*illus.*)	1018
Transmission Line Power-Arcs, by Paul Ackerman	1019
Central England Electricity Scheme, 1928	1020
The Institution of Civil Engineers	1021
Turbo-Electric *v.* Diesel Drive for Large Passenger Ships	1022
New Electrical Devices, Fittings, and Plant (*illus.*)	1023
Correspondence—	
Wood as an Insulator	1024
Trade Union Interference	1024
The Electrical Trades Benevolent Institution	1024
The Registration of Contractors	1024
Contracts of Service	1024
Developments in Current-Transformer Design	1024
Wanted—A New Word	1025
Published Specifications	1025
Trade Mark Applications	1025
New Work for Contractors	1026

The I.M.E.A. Convention.

THE Annual Convention of the Incorporated Municipal Electrical Association is easily the most important, as well as the most popular, of the several summer meetings of electrical men—and women, for the latter are playing a rôle of increasing significance in the development of electricity supply. The success of these gatherings, attended by some 800 or 900 persons, is largely due to their excellent organisation and to the immense ammount of preliminary work carried out by the honorary officials and the permanent staff, who deserve the greatest credit for their efficient labours; other factors are the municipal character of the participants, which ensures a hearty welcome from the local authorities, and, no doubt, the benevolent attitude of the Electricity Commissioners with regard to the expenses incurred. The last-mentioned item is fully justified not only by the official business that is transacted, but also by the opportunity afforded for the free interchange of ideas and experience, which renders the occasion one of great value to the supply industry.

This year the papers to be read deal with the supply and distribution of electricity in town and country, together with domestic electrification—on which subject women will be enabled to express their views, as they did so effectively last year. The generation of electricity is tending to become a matter for specialists, and though we have a long way to go before the small generating station is wholly superseded (if indeed that end is ever attained—which we doubt), the I.M.E.A. is wise in framing its programme on a basis of distribution, the most important department of electricity supply and the most difficult to conduct economically.

Distribution has two main aspects; providing the means, and promoting the demand; the former is a technical matter, the latter commercial, and both call for the closest examination and the shrewdest control. The necessity of providing mains of adequate capacity for future needs is a subject to which the Electricity Commissioners have already directed the attention of authorised undertakers; the high cost of service connec-

tions suggests that there is scope for improvements in method and design, and the importance which is now attached to the development of rural electricity supply is leading to the cheapening of overhead-line construction—all these are questions for the engineer. The manager has problems no less weighty to solve: the framing of an attractive tariff, the speeding-up of new connections, the stimulation of demand especially for domestic purposes, and the development of new classes of load with a view to levelling the load curve (such as off-peak water heating) afford ample scope for thought and opportunity for the exercise of originality and foresight. There is a great future before the engineer-and-manager who is willing to throw himself into the work with zeal and assiduity, and we hope the papers and discussions of the forthcoming Convention will inspire all who are engaged in electricity supply with new ardour and enthusiasm.

Electrical Refrigeration.

THE first British Electrical Refrigeration Campaign was inaugurated in London yesterday (Thursday) by a luncheon at the Hotel Cecil.

We showed in our last issue that there was a good potential market for electric refrigerators in this country of which certain foreigners were fully aware. This is confirmed by the report of the E.D.A. Refrigeration Sub-Committee which is mentioned in our "Business Notes." The Committee not only considers that there are good prospects if the necessary propaganda is conducted thoroughly, but is convinced that there are British-made refrigerators capable of meeting the requirements. There is, in fact, quite a wide choice in both the matters of system and of price, and we are sure that a determined effort, such as the present campaign, will enable a good many British refrigerators to find a sale which otherwise might go to foreign suppliers.

It would appear from the report that hire-purchase systems for refrigerating apparatus are essential. With such a long-lived apparatus as a refrigerator, business carried out in this way should not present very serious risks; this is one of the directions in which the experience of the United States is likely to be useful.

We consider that the Campaign will have a lasting effect and bring refrigerators into the greater prominence which they undoubtedly merit. It is quite amusing to note how accurately the gas interests have timed their own refrigerator campaign.

The Centenary of the Institution of Civil Engineers.

THIS week the Institution of Civil Engineers has been engaged in commemorating with due solemnity an event of the first importance in its existence—its incorporation by Royal Charter, which took place on June 3rd 100 years ago. On Sunday last a memorial service was held in Westminster Abbey, and on Monday the James Forrest Lecture was delivered by Sir Alfred Ewing; the three following days were devoted to an engineering conference, visits to important works, a conversazione, and a banquet. The Institution was informally founded in 1818; ten years later it obtained its Charter, and entered upon a career of distinction and public service which reflects the highest credit upon those responsible for the conduct of its affairs. It cannot be denied that the Institution of Civil Engineers has consistently maintained the highest standard of professional conduct, and has required its members to conform to the honourable traditions handed down by the great engineers whose names adorn its roll of members. Other engineering institutions have sprung up, modelled on the lines of its constitution, and have rivalled or surpassed it in membership and activity, but have specialised in more limited fields—the Civil Engineers alone claims for its sphere the subjection of all the resources of Nature to the service of man; and it retains to-day the position not only of the senior but also of the premier engineering institution in the British Empire, and perhaps in the whole world.

The Electrical Trade Position.

IN several recent issues we have placed on record an abstract of the material brought together by the Balfour Committee respecting the British electrical industry. It has formed an interesting story; familiar in many of its details, but well meriting the space devoted to it. This week we supplement it with some extracts of a more up-to-date character, from the current Quarterly Survey issued by the B.E.A.M.A. The Survey is, we believe, the most interesting, because the most optimistic, that the Association has issued. Material has been brought together which enables the compiler to arrive at the conclusion, which we and others have already expressed, that an immense demand should shortly be made upon our manufacturing industries in connection with the national electrical developments so long awaited. The view is expressed that the electricity supply industry is entering upon its first great period of revival. It might have arrived earlier if it had been possible for the electricity schemes to be advanced more rapidly. The demand for electricity has been increasing at a greater pace than our provision of plant and equipment to meet it, and mention is made of a possible glut of orders for generation, transmission and distribution equipment toward the end of this year because there has not been sufficient foresight in timely distribution of contracts. Complaint is made that, although three areas have been determined, there are insufficient signs of activity in the definite allocation of orders to meet the main requirements of all these schemes. The possibility of too much work coming at an inconvenient moment suggests as one consequence less improvement in employment of British workpeople than would otherwise be the case.

The Electrical Trades Benevolent Institution.

WE publish in our "Correspondence" section to-day a letter received from Captain J. T. Keeping, M.C., who was recently appointed secretary of this Institution. We commend this communication to the careful and sympathetic consideration of the whole electrical industry and trade, and hope that at the commencement of a new year's operations the Executive Committee and the writer of the letter will have abundant proof of the desire of everybody to co-operate in measures calculated to secure greater success. Mr. L. G. Sloan, who has accepted the office of president of the organisation for the year and will preside at the Festival Dinner which takes place in November, has had about thirty years' connection with the electrical trade, and those acquainted with his past record, apart from the electrical world, know that he is no stranger to what is involved in an effort to raise substantial funds for special objects of this kind. We would bespeak for him, for the committee, for the new secretary, and therefore for the Funds and the general benevolent activities of the E.T.B.I., the most generous support and the willingness to lend help in many local ways for placing the organisation in that very substantial position that our great industry both merits and needs. It should be understood that any suggestions regarding new ways in which it is thought the organisation may profitably broaden its activities will be welcomed at the office, 9, Southampton Street, London, W.C.1, but those who have followed the ingenious efforts that have been made from time to time will know that these have been most numerous and of a very varied nature. There is, of course, therefore, the possibility that some proposals may be found to have been anticipated and tried and others may already be in actual working. Those who are good enough to forward their ideas must not be disappointed if they find that to be the case; for example, one mentioned in another journal last week is by no means new, but want of knowledge on the part of journalists or of proposers is not surprising when the Institution has been at work so long.

The I.M.E.A. in the West Country.-I.

In view of the forthcoming Convention of the Incorporated Municipal Electrical Association, which is to be held at Bath next week, we give in the following articles a review of electrical progress in the Western counties, including the most recent developments in power supply in the Severn Valley.

THE decision of the Council of the Incorporated Municipal Electrical Association to hold the Convention of 1928 at Bath must have been cordially welcomed by all who were familiar with the simple beauties of the delightful countryside in which

Photo by] *[Judd 's, Ltd.*

Fig. 1.—Bath: The Grand Parade and Abbey.

that favoured city lies. Situated on the River Avon in a charming valley, served by three great railways, surrounded by hills and dales, only eleven miles from the great industrial metropolis of the west country and yet unspoiled, the City of Bath is ideally placed, and happily it is worthy of its setting; it is one of the most ancient and interesting cities in England, and justly claims the title of "Queen of the West." Its buildings, gardens, and monuments are of exceptional interest and beauty, and are rich in historical associations.

Traditional history relates that the healing springs were discovered and turned to good account by Prince Bladud, a leper who by their aid was cleansed; in due course becoming king, he reigned for many years, but unfortunately made himself wings and tried to fly, with disastrous consequences. No doubt the ancient Britons were acquainted with the virtues of the waters, for the Romans had not long held sway in Britain before they founded a city and built the famous baths, which must have covered many acres; the foundations of the buildings which remain, nearly 2,000 years old, were unearthed less than a century ago. Bath has had many ups and downs; but during the nineteenth century the city acquired an assured position as not only a pleasure resort, but also a most congenial residential town, and now relies not on the glamour of fashion, but upon the solid basis of merit and distinction, for patronage and prosperity.

The members of the I.M.E.A. who last year sampled the waters of Buxton will now have the opportunity of comparing them with the medicinal waters of Bath, which are poured forth from three springs at the rate of half a million gallons a day, at uniform temperatures of 114, 117, and 120 deg. F. respectively. In 1903 Sir William Ramsay found that the waters contained helium gas, of which 1,000 litres per annum is evolved; this proves that they pass through strata containing radium, the emanations from which probably are to be credited with some of the most valuable therapeutic properties of the Bath waters. Neon gas is also present in the water, the uses of which, needless to say, have been exhaustively studied and most elaborately provided for by the City Corporation with praiseworthy enterprise, whilst sheltered terraces, gardens, and music minister to the comfort of visitors "between drinks."

On the architectural features of Bath we have no space to dilate. The Abbey Church, 400 years old, is of great interest, and so is the pure Saxon church at Bradford-on-Avon, dating from the eighth century. Longleat, the seat of the Marquis of Bath, which some of the members will visit, has been described as "the most magnificent country house in England"; the name is derived from the aqueduct which feeds a lake in the deer park. Golf, boating, and fishing are, of course, amongst the many amenities of Bath.

Apart from the conference and business meetings, the programme is again a light one, the visits arranged being almost wholly recreative rather than professional. We have, however, thought it an appropriate occasion, for the benefit not only of the members but also of the vastly wider circle of our readers, to prepare a survey of the electrical and allied industries in the western counties, including therein particulars of the extremely interesting undertakings of the Bristol Corporation (Mr. H. Faraday Proctor, city electrical engineer, was one of the founders of the I.M.E.A.) and, in a later issue, the West Gloucestershire Power Co., Ltd. (Mr. H. S. Ellis, chief engineer and general manager). Moreover, though "West Ham" is by no means a westerly borough, despite its name, we have, of course, included an account of the recent developments in connection with its electrical undertaking, the head of which, Mr. Fredk. W. Purse, is president of the Incorporated Municipal Electrical Association.

Photo by] *[Judge's, Ltd.*

Fig. 2.—The Great Roman Bath.

Bath Corporation's Electricity Works.

Situate on the River Avon, almost in the heart of the city, the Corporation's electricity generating station is very different to-day from what it was in 1897, when the municipality acquired the undertaking of the City of Bath Electric Lighting and Engineering Co., Ltd. Fig. 10, p. 981, is a view of part of the engine room as it was in 1903; Mr. F. W. Purse, M.I.E.E., M.I.Mech.E., this year's president of the I.M.E.A., was connected with its early development.

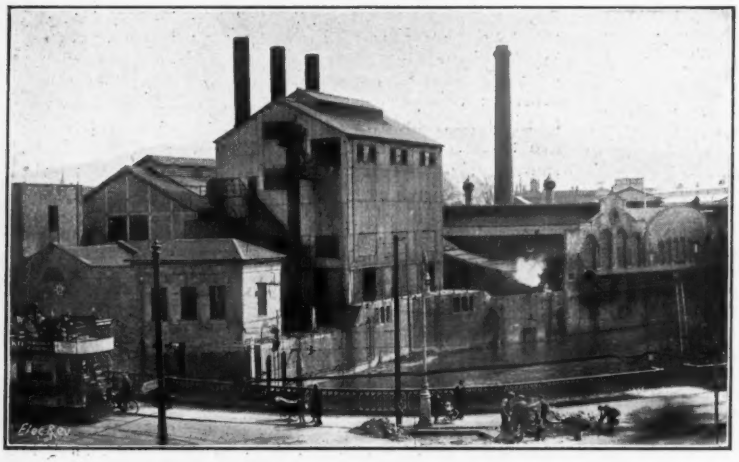


Fig. 3.—Bath Corporation Electricity Generating Station.

Under the control of Mr. J. W. Spark, M.I.E.E., and his deputy, Mr. A. R. Shapley, A.M.I.E.E., the undertaking now serves the city's population of 68,648 and surrounding districts, and has sold energy in bulk to the West Wilts. Electric Lighting and Power Co., Ltd., since 1925; the West Wells 11,000-volt transmission line is fed from two 1,000-kW Hackbridge transformers (a third is shortly to be added) through Ferguson, Pailin drop-down type switchgear.

Coal is delivered to the generating station (recent views of which are reproduced on p. 981, figs. 10, 11, and 12) by road and tipped into a pit, whence Stothert and Pitt elevators and conveyors deliver it to the boiler-house bunkers. Of the Babcock & Wilcox Clayton double-circulation type boilers, three are of 40,000 lb. each, fitted with Bennis and B. & W. chain-grate stokers; the fourth is of 25,000-lb. capacity and is oil-fired. Davidson draught fans and grit catchers are installed, and Weir steam-driven feed pumps and evaporator; a 43-h.p. motor-driven Mather & Platt feed pump of the latest pattern is being installed, together with de-aerating plant. Control instruments include "Mono" flue-gas recorders, Cambridge distance thermometers, Kent steam-flow meters, Lea coal meters, &c. Ashes are disposed of with the aid of a Stothert & Pitt wet conveyor. The steam pressure is 210 lb. per sq. in., and its superheated temperature 620 deg. F.

The generating plant consists of one 7,000-, one 3,000-, and two 2,000-kW Brush-Ljungström 3,000-r.p.m. turbo-alternators: one 500-kW Belliss-Dick, Kerr vertical reciprocating house-service set (all the auxiliary machines being d.c. driven), together with one 500- and one 1,000-kW B.T.-H. rotary convertors.

Brush motor-driven Matthews & Yates fans operating in conjunction with "Visco" filters cool the generators. The Brush condensers are provided with "Delas" air ejectors, Drysdale extraction pumps, and vertical-spindle Mather & Platt and Pulsometer circulating-water pumps driven by Brush motors, the river water passing through Brackett and Ledward & Beckett rotary screens.

The main switchgear is of Ferguson, Pailin make, the control board being separated from the switches by a brick wall; Merz-Price protection is employed throughout. Alternating current is generated at 6,600 volts, 3-phase, 50 cycles; by means of Scott-connected transformers and F. & P. 2,300-volt switchgear, the city is provided with 1-phase as well as 3-phase energy, and also 2- and 3-wire d.c.: consumers' pressures are 220 and 440 volts. Distribution is carried out by underground cables, and there are one rotary and one Hewittic mercury-arc sub-stations on consumers' premises.

The capital expended on the undertaking amounts to £586,127. It is estimated that a net profit of £4,000 will be the financial result of the year's working. The energy sold in 1927-28 was 8,759,087 kWh, or 127 kWh per head of population, the average price obtained being 2.29d. per kWh. Connections to the system totalled 13,580 kW, the maximum load being 5,440 kW and the load factor 22.75 per cent.

Stothert & Pitt, Ltd.

Few visitors to Bath, claimed to be the Queen City of the West Country, realise that it is the home of one of the oldest-established engineering firms in Great Britain. Established over 100 years ago in quite a small way, the works of Stothert and Pitt, Ltd., on the bank of the River Avon cover approximately 11 acres and are directly connected with the Great Western and Midland Railway systems. The employés number about 1,200 men.

The works are provided with excellent facilities for testing electrically-operated machinery at various voltages with both direct and alternating current, and a special testing transformer of the English Electric Company's manufacture is interesting for the fact that a very comprehensive range of 3-phase voltages can be obtained from it, as well as a 2-phase supply at 200 and 400 volts when the transformer is Scott-connected.

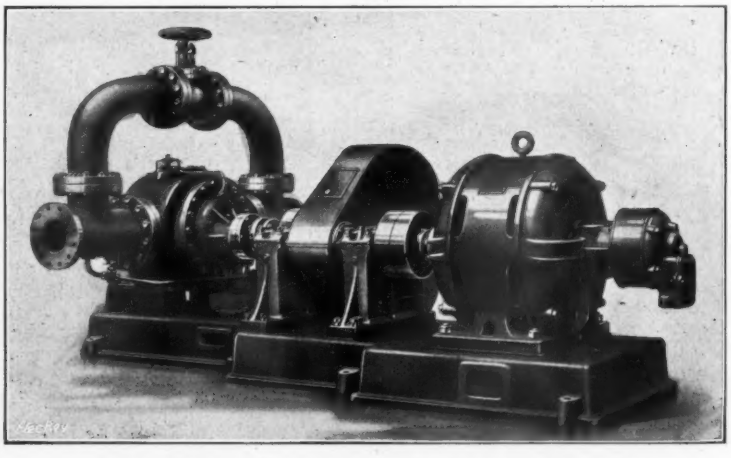


Fig. 4.—Stothert & Pitt High-temperature Asphalt Pump.

The whole of the works plant is electrically operated, and includes a number of interesting machine-tool drives arranged for variable-speed control. Electric power is purchased from the Bath Corporation: at the (Victoria) works is installed a 500-kW Mather & Platt

rotary convertor, while at the (Newark) works two Corporation feeders provide 440-volt d.c. and 3-phase, 6,600-volt supplies. It is possible to test all electrical machinery working on any normal 50-cycle or direct-current medium-pressure supply up to 200 brake horse-power. The products of the firm include all sizes and types of lifting machinery (of which figs. 13 and 14, pp. 981-2 are representative), in the design of which it has been a pioneer, ranging from cranes designed to handle comparatively small loads at high speeds to heavy "Giant," "Tower," "Titan," and "Goliath" types capable of handling loads up to 300 tons.

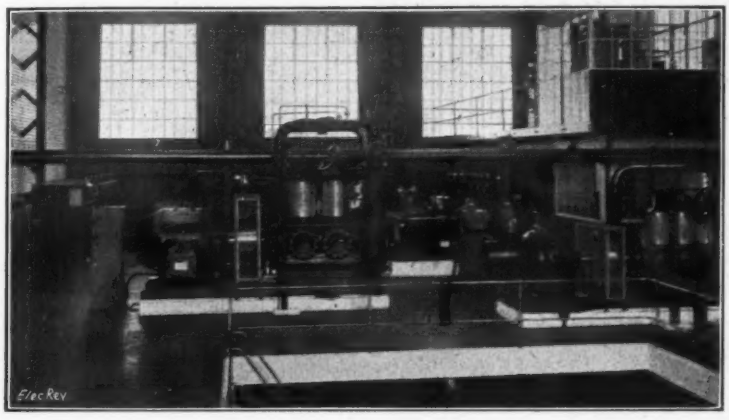


Fig. 5.—Part of Factory Power House, J. S. Fry & Sons, Ltd.

In the Concrete and Tarmacadam Department, some of the plant manufactured is of large size; for example, a plant now in hand is over 300 ft. high, and is capable of mixing and placing 1,500 tons of concrete per day. Most of the tarmacadam plant is used for road construction.

The Pump Department specialises in the manufacture of a rotary displacement type for fluids free from an appreciable amount of solid matter; ranging from the very small pump used on oil-burning plant to the large transfer and cargo-handling sets for outputs up to 500 tons per hour, the main field of the pump is that of dealing with fluids of appreciable viscosity, particularly on account of its simplicity and the absence of any such mechanism as valves. Such materials as ahphalt cable compound, &c., which has a setting point above that of the surrounding atmosphere, are normally raised to a certain temperature for pumping, and for this class of work a pump is made with a jacketed body and covers, which can raise the fluid temperature up to 380 deg. C. (fig. 4, p. 978).

Another separate department is concerned with the construction of conveyors, and plant has been supplied embodying from 12-in. wide to 48-in. wide belts, with capacities up to 800 tons per hour. A conveyor has been developed of the rope belt type, which can be adapted for working underground in collieries, and in this field of service a special type of face conveyor has been developed of the chain-belt design, embodying features that make it portable and capable of being readily extended.

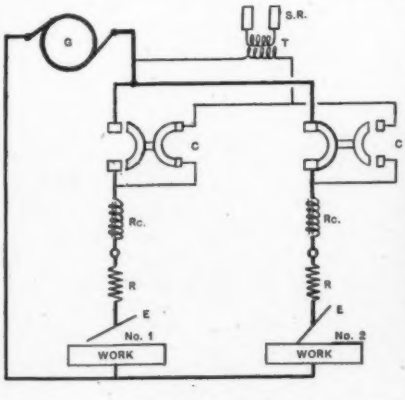
One department is entirely engaged on the production of a special form of variable increasing and reducing and reversing gear, the firm having the sole rights of manufacture of the "Burn" patents: an important feature is the entire absence of toothed wheels, the drive being imparted through the medium of slippers and the power carried by an oil film kept intact under pressure. A single control lever is capable of starting, stopping, and sustaining the load, or lowering it under power at any speed between zero and full speed. The efficiency has been certified by the National Physical Laboratory for a standard 2 to 1 reduction or increasing gear at 98 per cent.

Provision is made to ensure the health of all employés, and accident cases are dealt with in ambulance rooms in central positions in the works by trained men who are always in attendance. The employers have organised a branch of the St. John's Ambulance Brigade, members of which last year successfully treated 1,560 patients, including 40 hospital cases. For the sports club a resident whole-time groundsman is employed, and sports generally are organised and controlled by a whole-time sports secretary.

J. S. Fry & Sons, Ltd.

Founded in 1728, J. S. Fry & Sons, Ltd., need no introduction as manufacturers of cocoa and chocolate.

Steam heating, refrigeration, and electric power, each plays its part in the multitude of varied processes. At the Somerdale factory electricity supplied by the Bristol Corporation is relied upon entirely, and with a view to eliminating as far as possible any risk of a shut-down, two special cables have been laid direct from the factory power house to the Corporation's Feeder Road generating station: one to carry the load, and the other purely as a stand-by in case of trouble developing on the first cable. Power is delivered to Somerdale at 6,600 volts, three-phase, 50 cycles, and is stepped down through British Electric Transformer Co.'s transformers to 230 volts single-phase for lighting. Owing to the peculiar requirements of the factory, most of the industrial load is d.c., which is obtained by the usual step-down transformers and rotary convertors, two being of Metropolitan-Vickers make and of 500 kW each, and the third a 250-kW



Figs. 6 and 7.—A.D.C. Electric Welder Di agram (Mawdsley's, Ltd.), and Dursley Works.

machine made by the British Thomson-Houston Co., Ltd. The complete installation is in accordance with up-to-date practice, the only point of special interest being in connection with the service water pumps, which are driven by 50-b.h.p. British Thomson-Houston slip-ring motors and controlled by float switches; automatic starters are arranged to re-introduce the starting resistances into the rotor circuits before the pumps stop, and by thus slowing down the pumps gradually, the body of moving water in the pipes is steadily decelerated until it finally comes to rest without shock of surging. Fig. 5. p. 979, and figs. 16 to 20, pp. 982-3, are views of the factory plant.

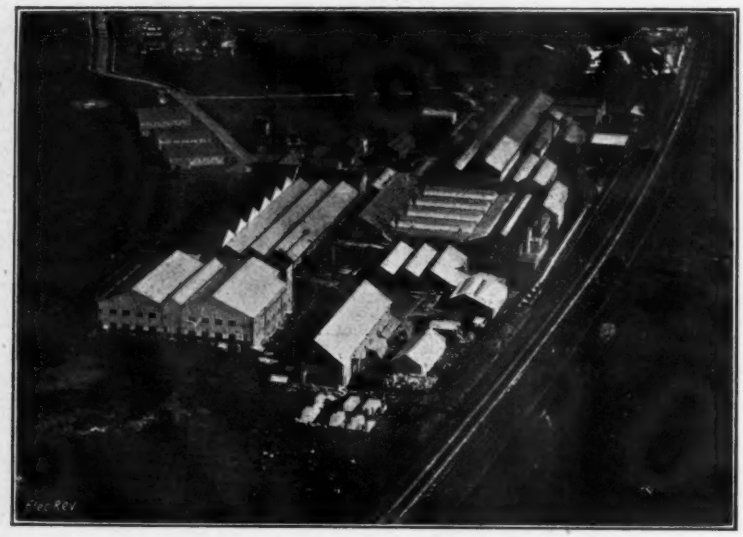


Fig. 8.—The Yeovil Works of Petters, Ltd.

At the Union Street (Bristol City) factory the supply is also 6,600 volts, 50 cycles, three-phase, stepped down through transformers for lighting and power: d.c. is provided by two 500-volt, 500-kW Metropolitan-Vickers rotary convertors, with the addition of one Crompton rotary which has been arranged for inverted running. The lighting distribution system is at 105 volts a.c. from Berry air-cooled Scott-connected transformers, supplied through special feeders from the main 400-volt three-phase switchboard. In addition to the Corporation supply the factory has a stand-by steam generating plant consisting of two tandem compound Davey-Paxman engines running at 180 r.p.m. and directly coupled to two 350-kW Crompton d.c. 500-volt generators. With the aid of these engines, in conjunction with the inverted running of the Crompton rotary, it is possible to feed back through the transformers and provide lighting throughout the factories, if at any time the Corporation supply should fail, in addition to providing a certain amount of d.c. power for factory purposes. This stand-by proved very useful during the last general strike when the Corporation was unable to provide Messrs. Fry continuously with their full requirements. It was also used for a short time for providing lighting, owing to a temporary complete shut-down of the Corporation supply. Apart from the above, there are no outstanding features in connection with the electrical equipment, except the telephone system, which is automatic throughout, both at Union Street and Somerdale, with interconnecting lines between the two groups of factories. At Union Street 175 lines are in use and 50 at Somerdale, operated on the well-known Strowger system; the equipment was made by the Automatic Telephone Manufacturing Co., Ltd.

Mawdsley's, Ltd.

Established in 1907 at the present works at Dursley, in Gloucestershire, Mawdsley's, Ltd., manufacture d.c. motors and dynamos as well as polyphase a.c. motors. The construction of special machines to customers' requirements represents a large part of the business, and we believe we are correct in stating that the Company holds the following three records:—

High-speed d.c. motor, 25 h.p. at 10,000 r.p.m.

Light-weight dynamo, 360 kW at 1,200 r.p.m., weight 14 cwt.

Light-weight motor, 215 h.p. at 2,000 r.p.m., weight 9 cwt.

The two last-mentioned machines were made for the Air Ministry during the war period. Ordinary industrial d.c. motors are made in all the usual types, and it is of interest to note that the Company has supplied an aggregate of 11,000 h.p. of such machines to one large industrial firm in this country alone.

Machines are also specially designed for use in measuring the horse-power of petrol engines, &c., and a considerable number of ventilating-fan motors are made for installation on torpedo boat destroyers (some of this type being at present in hand for the Chilean destroyers now being built by Thornycroft, Ltd.), besides "turning" motors for recently-built cruisers.

Views of the works are reproduced in fig. 7, p. 979, and figs. 21, 22 and 23, p. 983. One speciality is the manufacture of electric welding machinery, including rotary convertors for spot welders; in addition to making drooping-charcteristic and level-compounded outfits, single- and multi-operator machines are produced which are claimed to be novel. The fact that about 65 volts is required for striking the arc, although about 25 volts at the electrodes suffices for the actual welding operation, necessitates the provision of more power than is really necessary to drive the dynamo and the use of wasteful resistances to absorb the difference in pressure. Although the drooping-characteristic generator is an improvement in this respect, it can only be employed in the case of single-operator machines. The A.D.C. system, however, enables the dynamo to be built of a sufficient size to furnish the current required at a constant voltage of, say, 30 to 35 volts. Two slip rings are fitted to the armature inside the machine, and from them an alternating current at a low voltage is fed to the primary winding of a small transformer, the secondary winding of which is connected to an automatic contactor switch so arranged that when the operator is not welding, an alternating current of 30 to

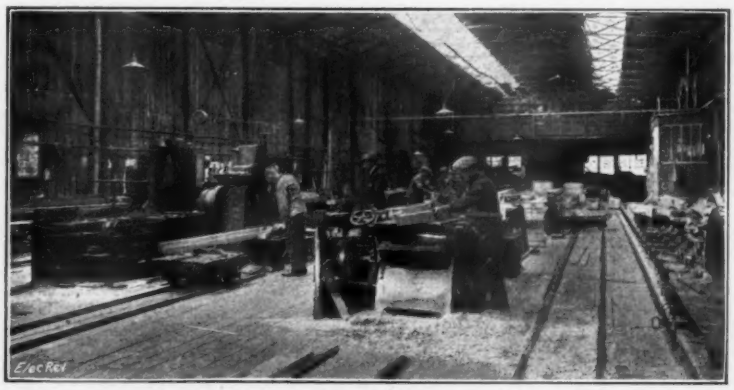
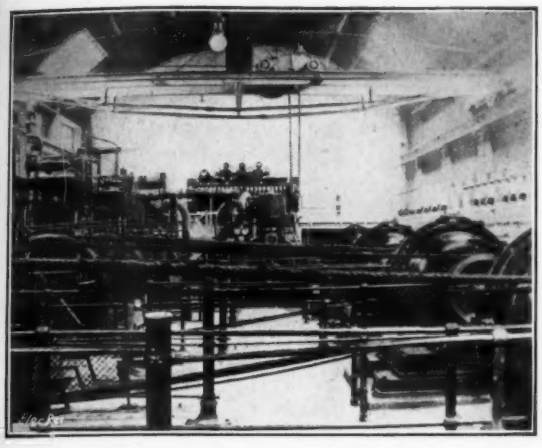
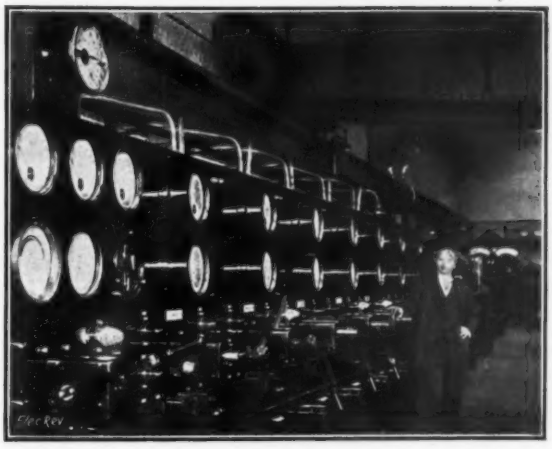


Fig. 9.—Wood-working Machine Shop, Westinghouse Brake and Saxby Signal Co., Ltd.



Engine Room in 1903.



6,600-V Switchgear Control Board.

Figs. 10 and 11.—Bath Corporation Electricity Generating Station.

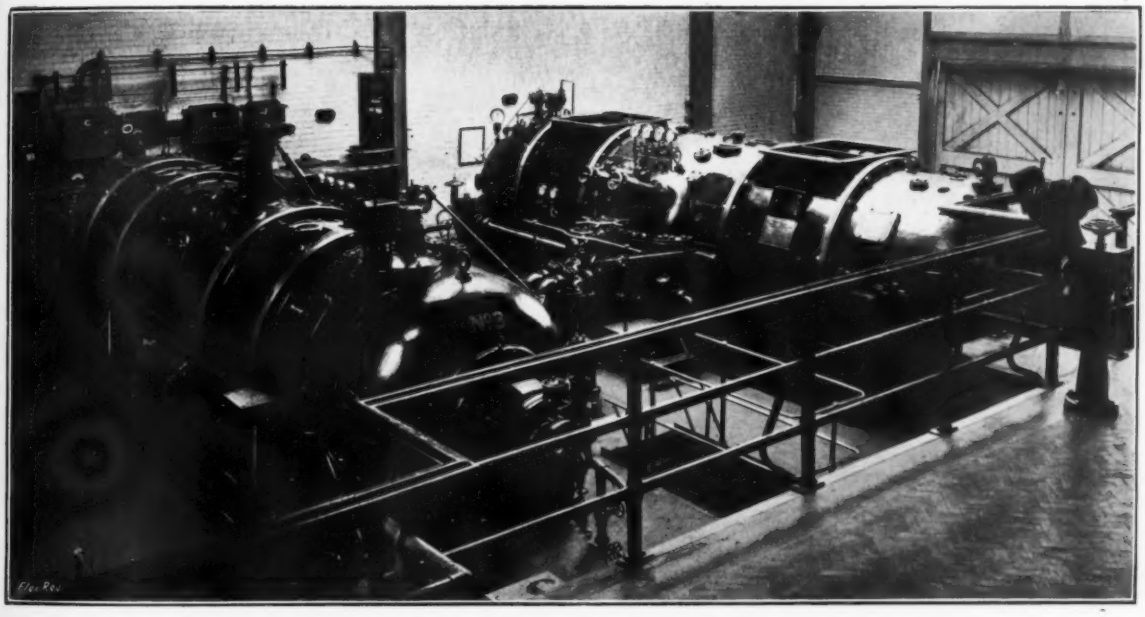


Fig. 12.—Brush-Ljungström Turbo-Alternators in Municipal Power House at Bath.

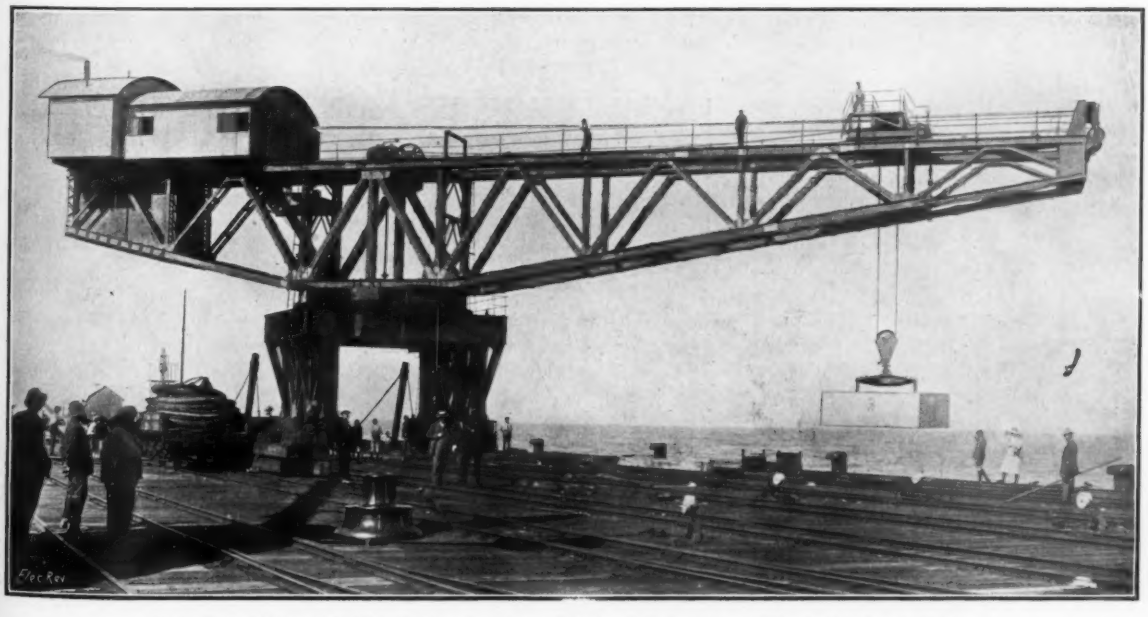
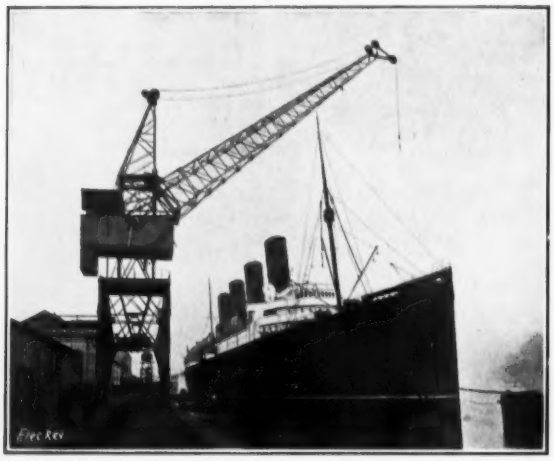
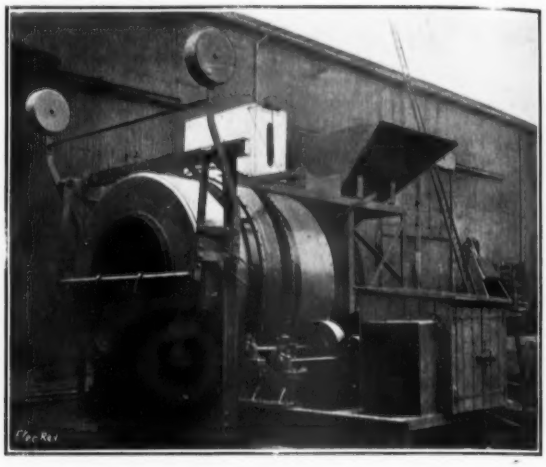


Fig. 13.—Stothert & Pitt "Titan" Crane Block-setting at Port Elizabeth, South Africa.



5-ton Crane at Southampton Docks.



Direct Motor-driven Concrete Mixer.

Figs. 14 and 15.—Some Products of Stothert & Pitt, Ltd.

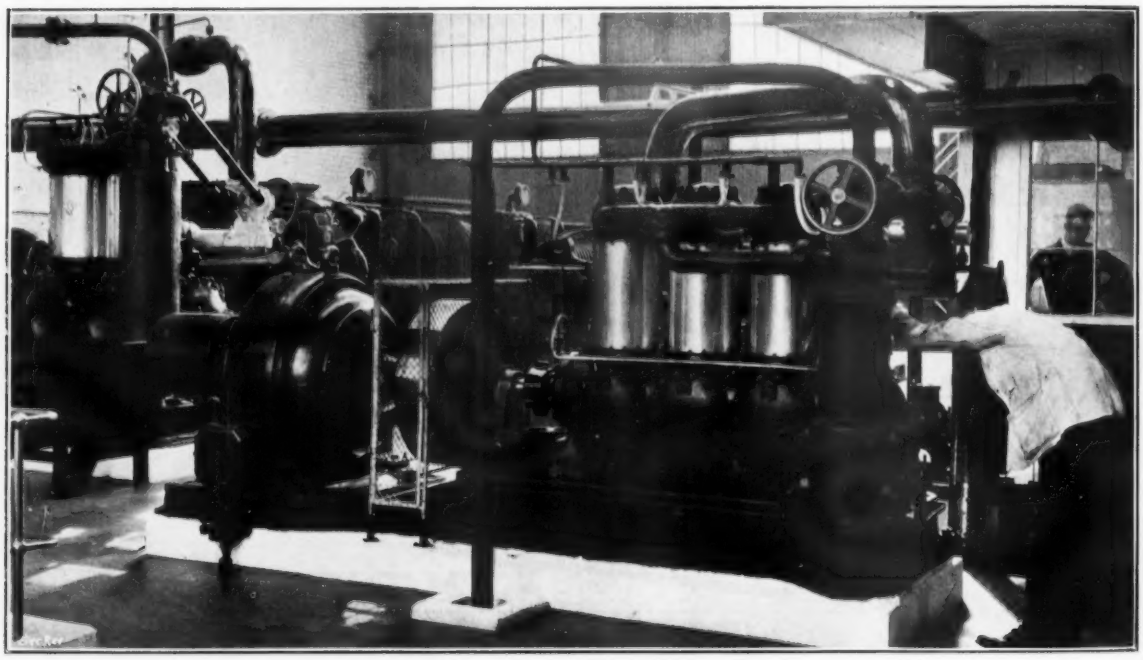
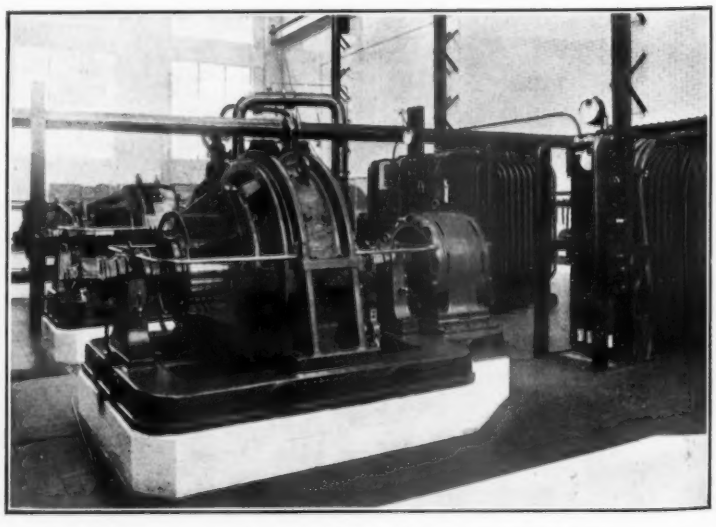
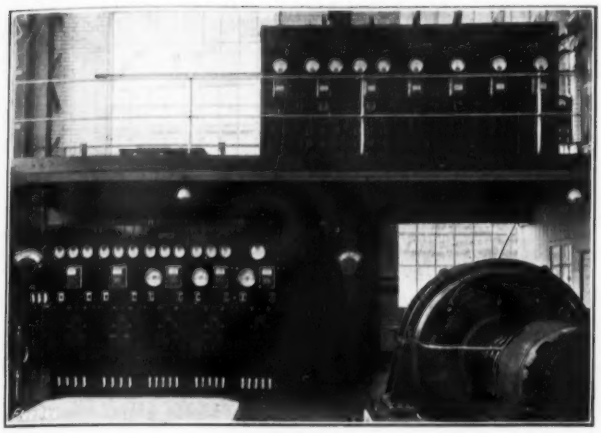


Fig. 16.—Power House Plant at the Somerdale Factory of J. S. Fry & Sons, Ltd.



Figs. 17 and 18.—Factory Power Control Board (J. S. Fry & Sons, Ltd.) and Rotary Convertors.



Figs. 19 and 20.—Switchgear in Chocolate Factory of J. S. Fry & Sons, Ltd.

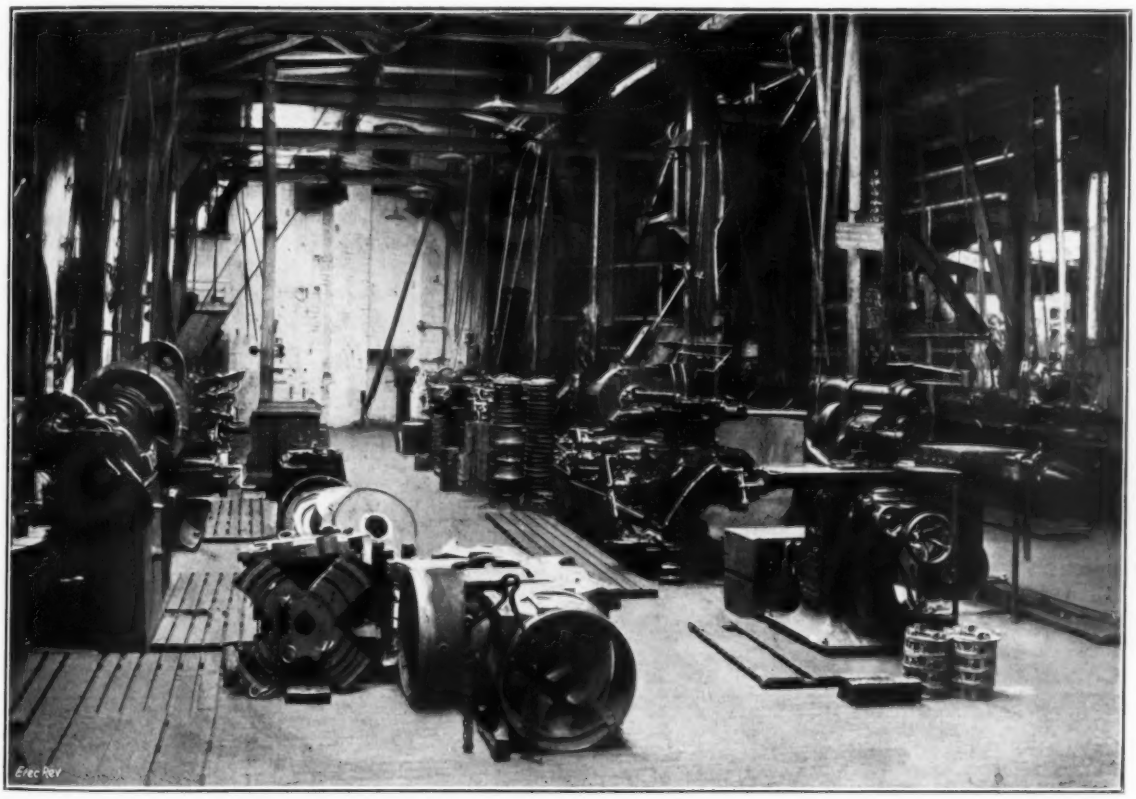
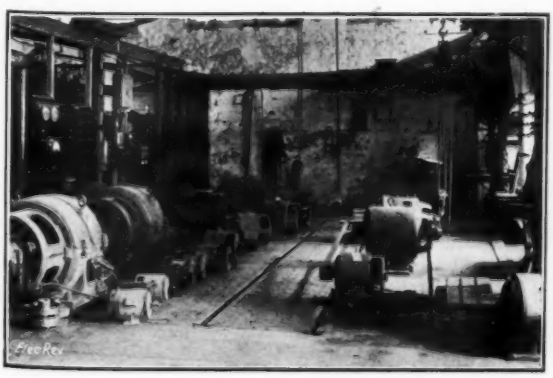
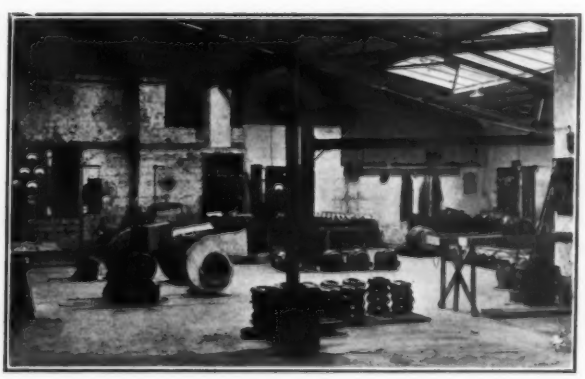


Fig. 21.—Part of Dursley Works (Mawdsley's, Ltd.) Machine Shop.





Figs. 22 and 23.—Views of Electrical Test Bays, Mawdsley's, Ltd.

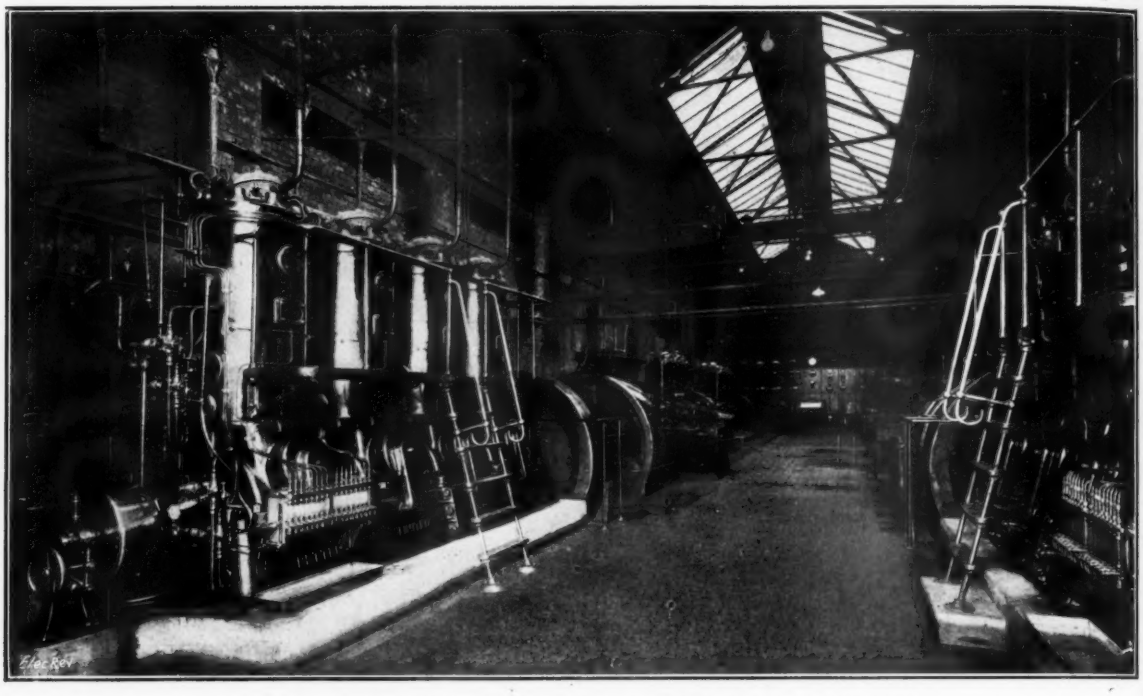


Fig. 24.—Oil-engine-driven Power House at Yeovil Works of Petters, Ltd.

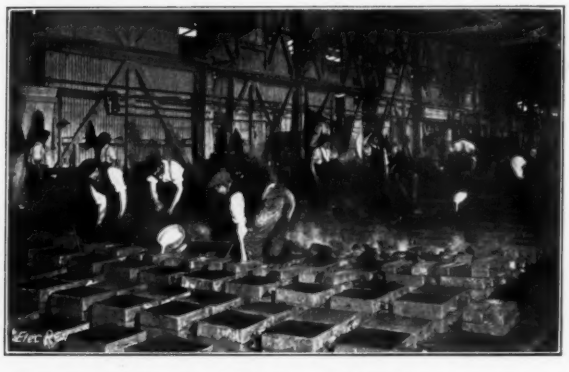


Fig. 25.—Light Castings Bay, Westinghouse Brake and Saxby Signal Co., Ltd.

Fig. 26.—Part of Machine Shop, Petters, Ltd.

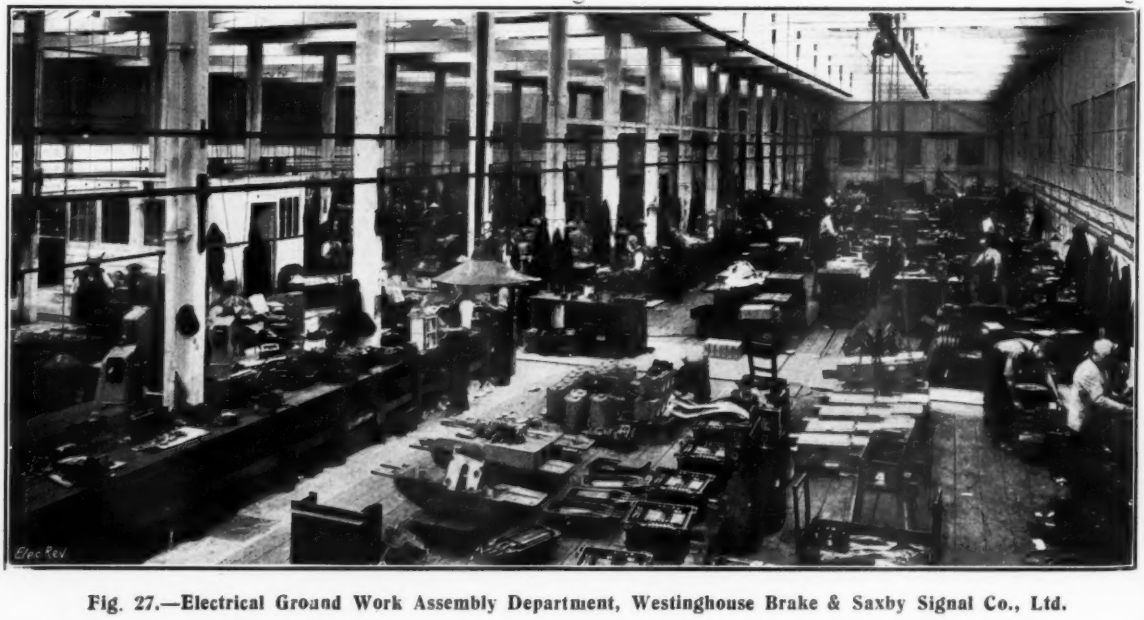


Fig. 27.—Electrical Ground Work Assembly Department, Westinghouse Brake & Saxby Signal Co., Ltd.

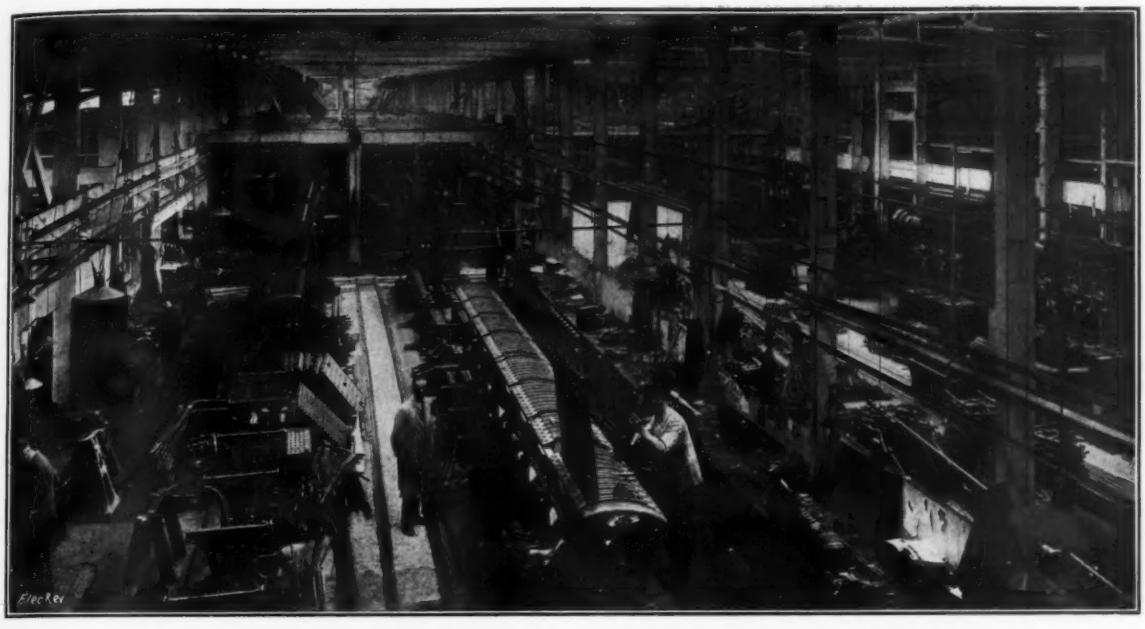


Fig. 28.—Mechanical Assembly Department, Westinghouse Brake and Saxby Signal Co , Ltd.

Fig. 29.—Electrical Test Room and Laboratory, Westinghouse Brake & Saxby Signal Co., Ltd.

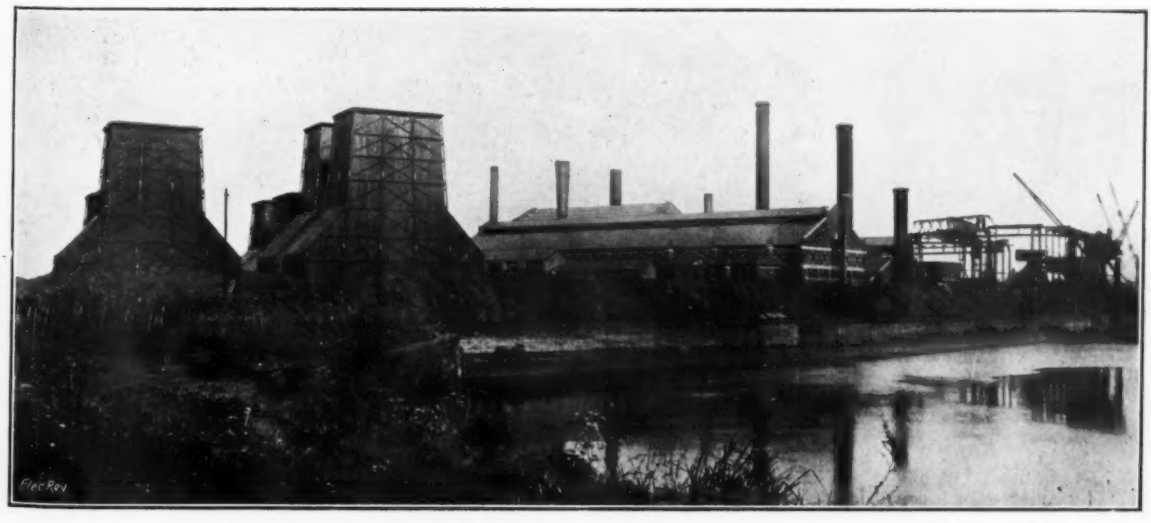


Fig. 30.—West Ham County Borough Council Electricity Generating Station.

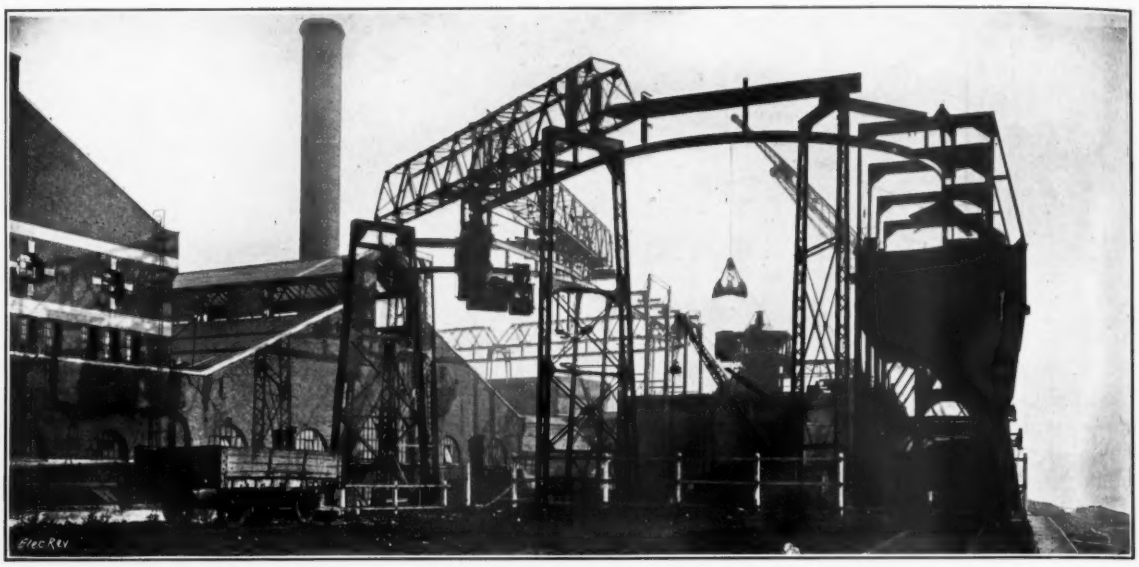


Fig. 31.—Coal-handling Plant at the West Ham Power House.

Figs. 32 and 33.—Boiler House, and Condenser Circulating Water Pump, at West Ham.

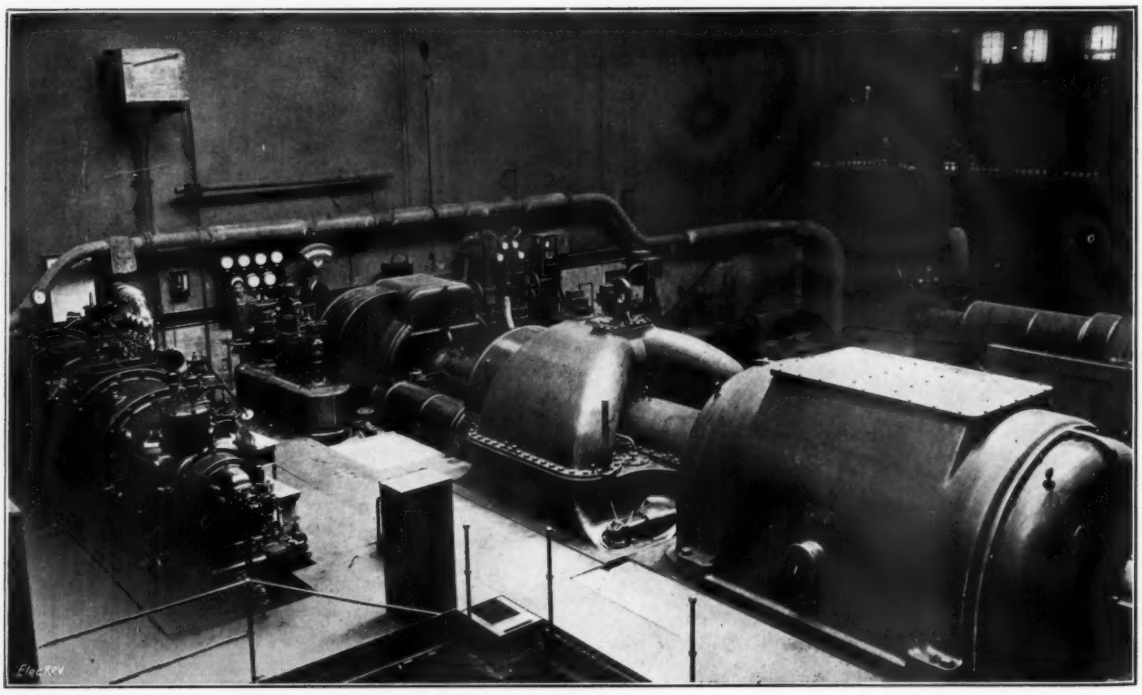


Fig. 34.—Turbo-alternator Room at the West Ham Municipal Station.

Fig. 35.—Bristol Corporation Electricity Generating Station at Feeder Road.

Fig. 36.—Site of Bristol City's New Capital Station at Portishead, photographed from an Aeroplane.

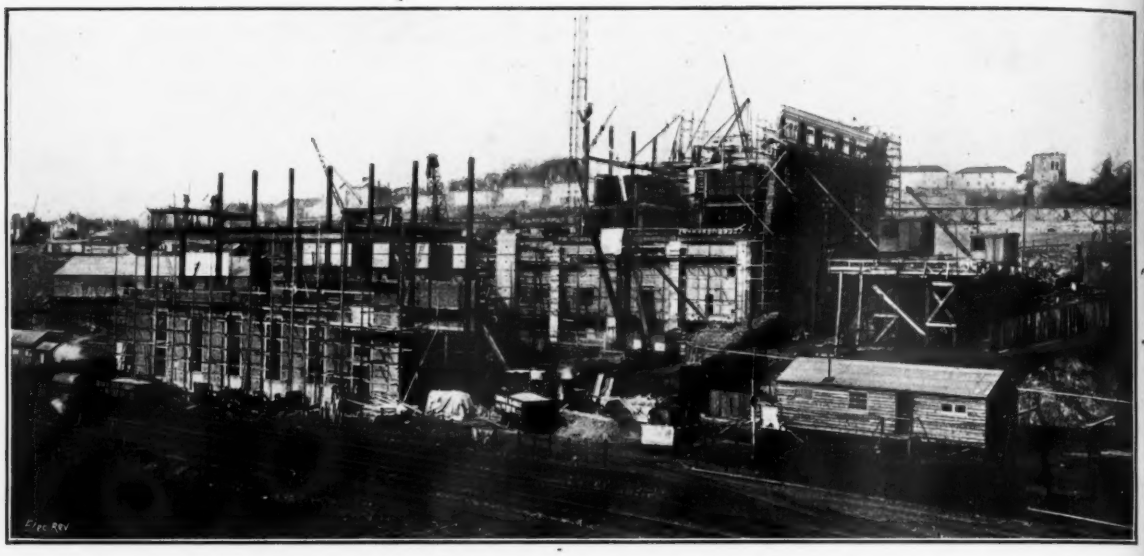


Fig. 37.—Bristol's Portishead Power House in Course of Erection.

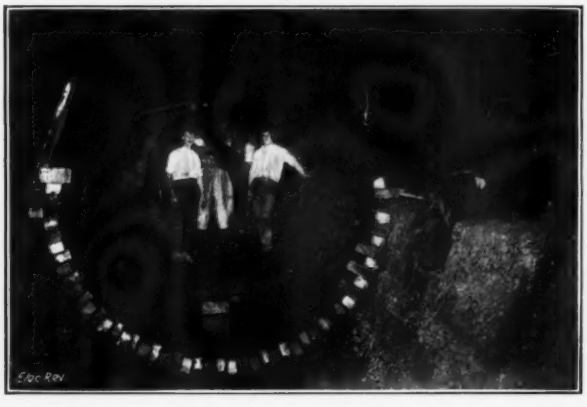


Fig. 38.—Brick-lined Condenser Circulating Water Culvert.

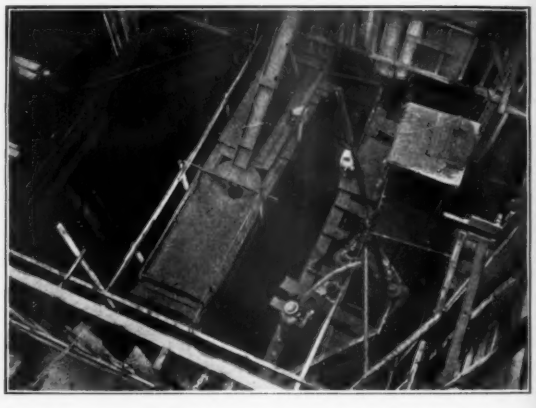


Fig. 39.—Condenser Pit under Construction at New Station.

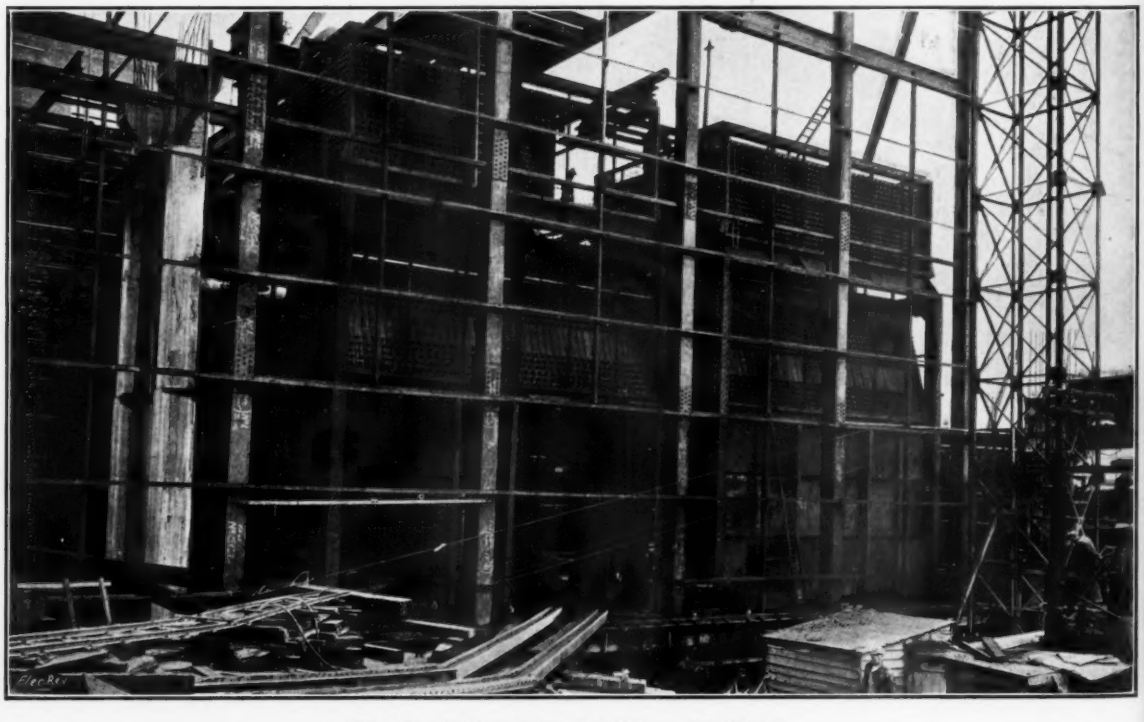


Fig. 40.—Boilers being Erected at Portishead.

928.

Station.

35 volts is put in series with the d.c. voltage from the welding dynamo, thus giving the operator the required striking voltage on his electrode. As soon as the arc has been struck, the contactor switch makes the main circuit, and at the same time cuts out the a.c. circuit, the electrodes being then supplied direct from the low-voltage welding dynamo. Each operator's circuit has an automatic contactor switch so that every operator is entirely independent of others who may be working off the same dynamo. The only resistances in circuit are the reactance, which is desirable with all welding plant to smooth out sudden current rushes, and a small steadying resistance; the power required to drive the dynamo is reduced to a minimum, and the plant takes up no more space than does an ordinary 35-V dynamo. The simplicity of the A.D.C. system will be seen by reference to the diagrammatic sketch of the connections required for a two-welder plant (fig. 6, p. 979): G is the welding generator; SR the slip rings mounted in the generator; T the transformer; C the contactors; R the small regulating resistance; RC the reactances; and E the electrodes; the sketch indicates the position of the contactors when No. 1 is not welding, No. 2 only being in operation.

Petters, Ltd.

Established in 1895, at a time when oil engines were in their first stages of evolution, the original works of Petters, Ltd., were at the eastern end of Yeovil. To-day the Westland Works occupy a 12½-acre site purchased in 1913 at the western end of the town in surroundings as unlike those of the average factory as can be imagined: the single-story buildings have an air of spaciousness that is enhanced by the flower-bordered paths that surround them; along one side runs the Great Western Railway track, around three sides are long stretches of meadow land, and on the fourth lies the aerodrome, over a mile in its girth (see fig. 8, p. 980). The manufacture of aeroplanes, which commenced in 1915, and internal combustion engines ranging from 1.5 to 36 h.p. in size, affords employment for over 1,200 workers; the larger engines of from 25 to 600 h.p. have been made at the Company's Ipswich works since 1919. The types made include marine, stationary, and portable (for contractors, farmers, &c.), vertical, single- and multi-cylinder engines consuming petrol, paraffin, or crude-oil fuel. The iron foundry is one of the largest in the south of England, and the works are provided with electric light and power from a central station (fig. 24, p. 984), which contains eight oil engines coupled to dynamos.

Four-stroke cycle engines were made from 1895 to 1910, when a two-stroke type was placed on the market: both types were manufactured until 1915, since when 2-stroke engines only have been produced. Magneto ignition engines are made in sizes of 1.5, 3 and 5 b.h.p. With regard to oil engines, the term "semi-Diesel" has been discarded in favour of "surface ignition," a cold starter having been introduced in 1923: it consists of a paper tube containing a special preparation which, when ignited, furnishes the necessary heat for igniting the fuel and enabling the engine to run long enough for the tube holder to become sufficiently hot to maintain combustion. The cold starter places the oil engine practically on a par with the petrol engine for ease of starting. This is the standard method of starting, but, if preferred, and according to type and size of plant, a blow lamp may be used.

The Company claims that 50 per cent. of the engines dispatched from its works are used for generating electricity on board ships, for villages, country houses, farms, institutions, factories, kinema theatres, &c. They can be arranged for belt driving or for coupling directly to alternators or dynamos, for direct lighting or for use in conjunction with storage batteries as required. In the smaller plant for house-lighting, the switchgear includes a starting switch, the generator acting as a motor when starting the engine. In confined spaces a fan-cooled radiator may be employed in place of water-cooling tanks. "Petter-Light" plant is obtainable on the hire-purchase system.

Westinghouse Brake and Saxby Signal Co., Ltd.

Established in 1896 at Chippenham, in Wiltshire, by Evans, O'Donnell & Co., Ltd., for the manufacture of mechanical signalling apparatus, what was locally known as "The Foundry" was acquired in 1903 by Saxby & Farmer, Ltd., of Kilburn, who then transferred their works to Chippenham and greatly extended the factory, which was still mainly employed in the production of mechanical signal apparatus, although a considerable quantity of plant for pneumatic signalling and tools was also manufactured. During the war period the works were devoted entirely to the production of munitions, such as gun sights, 18-pounder shells, rocking bars, &c.

In 1921, on the amalgamation of the Westinghouse Brake Co., Ltd., with McKenzie & Holland, Ltd., Saxby and Farmer, Ltd., and the McKenzie, Holland and Westinghouse Power Signal Co., Ltd., they became known as the Railway Signal Works of the Westinghouse Brake and Saxby Signal Co., Ltd., and very considerable extensions thereto have been made during the past seven years. They are now practically self-contained, and admit of the manufacture from start to finish of the bulk of the apparatus produced, cover an area of 10 acres and include one of the most up-to-date foundries in the country devoted exclusively to the production of railway signalling and other safety appliances, an electrically-operated shop for the production of drop forgings and stampings, varying in weight from 1 oz. to 40 lb., pattern shops, machine shops, and testing, galvanising and electro-plating rooms, &c., with accommodation sidings to the Great Western Railway. While the main output of the works (some parts of which are illustrated in fig. 9, p. 980, and figs. 25, 27, 28, and 29, pp. 984-5) still continues to be devoted to signalling apparatus, both mechanical and power-operated, the castings required by the London works for Westinghouse brake apparatus for both railway and road vehicles are produced at Chippenham; the output of electrically-driven air compressors for railway and other purposes is large, the whole of the parts for which, including the electric motors, are manufactured at the works.

A recent addition to the products of Chippenham is the Westinghouse metal rectifier for battery charging, &c.,* the demand for which has necessitated further additions to the shops.

As regards power signalling, recent notable deliveries from Chippenham have included:—

A 179-lever locking frame for the electro-pneumatic signalling of Temperley station at Buenos Aires.

A 275-lever locking frame for a similar installation at Plaza Constitucion.

A 131-lever electro-pneumatic locking frame for the Victoria terminus of the Great Indian Peninsula Railway, Bombay.

A 143-lever locking frame for all-electric signalling at Cape Town, South Africa.

Two all-electric locking frames of 107 and 143 levers, respectively, for Charing Cross and Cannon Street, London, Southern Railway.

A 311-lever all-electric locking frame for London Bridge, Southern Railway, this being the largest locking frame of its kind yet manufactured.

Work in hand includes all-electric locking frames for the resignalling of Victoria and Exchange stations at Manchester.

The number of hands employed at Chippenham is 1,200, equal to approximately one-seventh of the population of the town.

* See ELEC. REV., November 11th, 1927, p. 833.

The West Ham Electricity Undertaking.

Electricity supply in West Ham dates back to 1895: to-day the undertaking over which Mr. F. W. Purse, M.I.E.E., M.I.Mech.E., president of the I.M.E.A., presides electrically serves some 10,700 consumers of all classes, representing a loading of 58,286 kW, and a generating plant capacity of 46,500 kW. In 1919, when Mr. Purse took over the chiefship of the undertaking, the capacity of the plant installed amounted to 19,100 kW.

Perhaps the most striking feature of the station (figs. 30 to 34, pp. 985-6), which is situated at Canning Town on a bank of the River Lea, is the absence of the "temporary end" to the turbine room, which characterises most power stations to-day. The scrapping and replacement programme has been going on gradually, but continuously, since 1922. No doubt the absence of building operations each time the plant has been extended is reflected in the happy position of the undertaking as regards its low capital cost of £15 per kW of plant installed in the generating station, which figure will be reduced to £12 per kW when the new 30,000-kW set is installed.

Confining our atention to the up-to-date plant only, the equipment may be said to consist of four 10,000-kW turbo-alternators, one 5,000-kW set, and a 1,500-kW house turbine set in the turbine room, and four 35,000-lb. Babcock & Wilcox marine-type and two 40,000-lb. Stirling tri-drum boilers in the boiler house. The last three turbines are all Metropolitan-Vickers machines, one a single-cylinder and the others double-cylinder units. They all run at 3,000 r.p.m. and have steam stop-valve conditions of 190 lb. per sq. in. and 610 deg. F. The main turbines are each directly connected to a two-phase alternator generating at 6·7 kV. The house machine runs directly connected (electrically) through transformers and gives a 400-V, two-phase supply for the station auxiliaries. It can, however, be run on supply if necessary. The boilers are designed for a working pressure of 210 lb. per sq. in. and 630 deg F. superheat. They are fitted with Illinois compartment stokers.

With regard to the equipment about to be installed, the main items are a 30,000-kW English Electric Co. turbo-alternator, and two 150,000-lb. 3-drum Stirling boilers. The turbine is said to be the largest built to run at 3,000 r.p.m. This machine and the two existing double-cylinder 10,000-kW sets are to be arranged so that the boilers will have a closed-feed system with the necessary evaporators.

For the circulating water for the station there are two main inlets in the bed of the river. Water is taken into the ponds of cooling-tower plant and thence to the condensers. The discharge is taken partly to the towers and the remainder back to the river. It is claimed that with this combination of river and towers the efficiency obtainable from river water and the reliability of cooling towers are both secured. Four circulating pumps with a capacity of nearly 1,000,000 gal. per hour each perform the necessary pumping. Fig. 33, p. 986, shows one of the pumps, each of which is driven by a 300-h.p. motor. Two new Davenport towers are being put down in connection with the new extensions, making ten of that make in all. The scheme of water-treatment employed is interesting. The greatest trouble with the circulating water was caused by small organisms which normally carried with them a sticky substance which was readily deposited in the condenser tubes. By partially chlorinating the water the organisms are "doped" and the stickiness disappears.

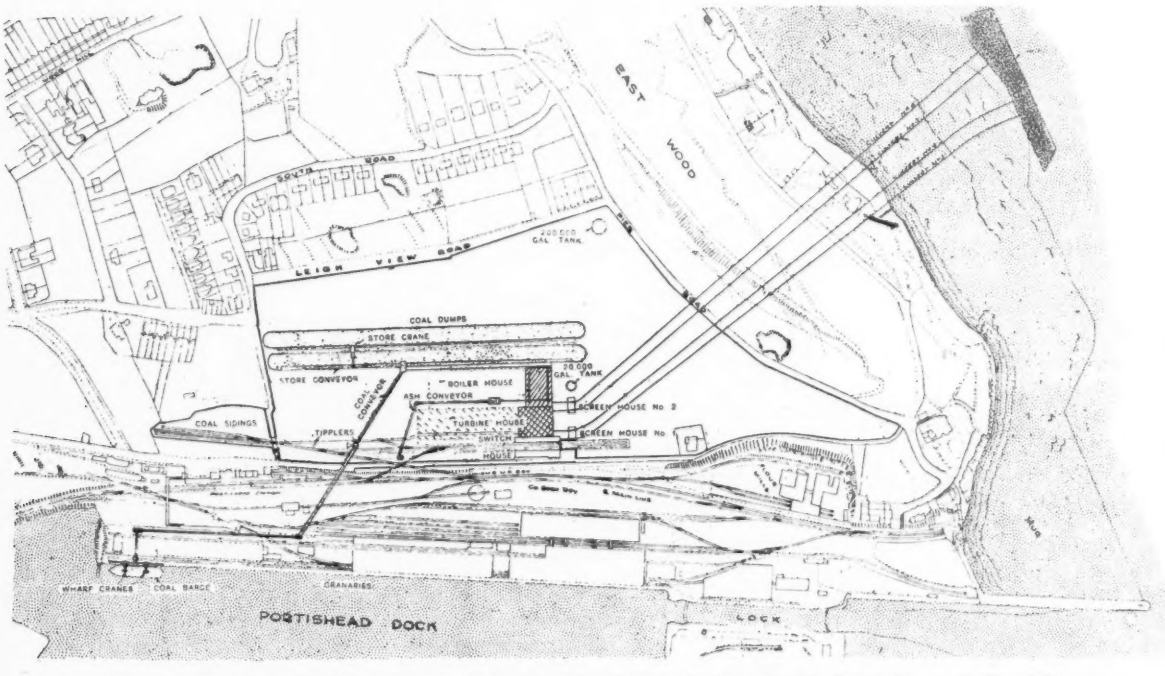


Fig. 41.—Site plan of Bristol's New Station, Portishead Dock in Foreground, River Severn to the right.

The coal-handling arrangements at the station are worthy of note. There is a ring-track telpher which passes over the boiler bunkers and storage heaps, and this is served with water-borne coal by means of two cranes (60 tons per hour), fitted with automatic grabs. On the way to the telpher there is an automatic coal sampler which gives an absolutely representative sample of each barge load.

The switchgear is not excluded from the reconstruction programme; indeed, an unusual scheme is in progress in that connection. The whole of the e.h.p. equipment is being replaced or reconstructed in order to bring the rupturing capacity of each switch up to 500,000 kVA. This has been rendered necessary by the rapid increase in the plant capacity during the past few years. The scheme is designed to provide for a final output of 70,000 kW without the use of bus-bar reactance. The whole of the switchgear work is being done by the British Thomson-Houston Co., Ltd.

We understand that the question of changing-over the systems of generation and distribution from 2-phase to 3-phase has been examined with the Electricity Commissioners, and in the absence of any strong technical reasons it has been decided not to embark on any conversion scheme.

The energy generated by the undertaking for the year 1927-28 amounted to 98,000,009 kWh, while the fuel consumption per kWh generated amounted to 1.85 lb,. against 4.2 lb. for the year 1918.

Turning to the distribution side of the undertaking, it is interesting to note that since the rental wiring scheme vogue was started about two years ago the rate of connections to the mains for new consumers has increased from 400 to 2,000 per annum. There is a scheme awaiting sanction which provides for the laying of cables in all the streets of West Ham. Included in the many large consumers supplied by the undertaking are the Port of London Docks and East Ham and Ilford. The two boroughs are supplied in bulk at special charges based on the generating costs at West Ham.

The Council has approved of further price reductions, which will bring the lighting charges down to from 3.5d. to 2.5d. per kWh, and the average price for power considerably less than 1d. per kWh; all the other charges will be reduced in about the same proportions.

With regard to the financial position of the undertaking, there is a reserve fund of £127,000 and a floating working capital of £60,000, and out of a total capital expenditure of £1,291,967 no less than 62 per cent. has been repaid, so that the undertaking may be said to be in a very strong financial position.

The Bristol Corporation Electricity Undertaking.

An increase in the amount of electrical energy sold during the past seven years of 128 per cent. is an achievement of which the municipality is justifiably proud: its new generating station has novel condensing water arrangements, and is designed for extension to a capacity of 280,000 kW.

SITUATE partly in Gloucestershire and partly in Somerset, divided by the River Avon, the Port of Bristol is a city and county unto itself, the city area of 18,686 acres having a population of over 383,300 people.

A municipal supply of electricity first became available from the Temple Back generating station (now a sub-station) in 1893, and another station at Feeder Road was formally inaugurated in 1902; both occupied river-side sites, but cooling towers have had to be utilised in latter years. The chief engineer and general manager, Mr. H. Faraday Proctor, M.Inst.C.E., M.I.E.E., has held that position for over 35 years. He was one of the founders of the I.M.E.A., past president, past hon. secretary, and is now hon. treasurer. Mr. A. J. Newman, M.I.Mech.E., M.I.E.E., who has been with the undertaking for over 25 years, is deputy engineer. The progress of the undertaking is reflected by the fact that during 1920-27 the energy sold increased from 30 to 64 million kWh, no mean achievement even in these days of impressive figures. Last year the effect of the protracted dispute in the coal-mining industry was a reduction of the gross profit by £24,708 to £184,932; nevertheless, the energy sold amounted to 67,596,193 kWh (an increase of 3,412,456 kWh only, compared with 8,100,846 kWh the previous year), and the accession of new consumers was maintained; the total number was 23,922, the increase of 3,684 during the year constituting a record. The energy sold for the year 1927-8 approximated to 84 million kWh, and the increase in the number of consumers for the year was 4,530.

The net surplus for 1926-7 was £28,332, after contributing £17,000 towards the relief of the general district rates. The total cost amounted to 1.07d. per kWh, and 2.7 lb. of coal was consumed per kWh produced, the average price obtained being 1.69d. per kWh. Some 4,745 motors (aggregating, with heating apparatus, 66,623 h.p.) represented the power load, and 865 cooking stoves were in use. Over 683 miles of cable has been laid, and Table I (p. 992) shows the number of sub-stations feeding the network.

The total plant capacity is 42,390 kVA: the 29,000 kVA of 3-ph., 50-cycle, 6,600-V plant generated 48,062,033 kWh (4-wire 365-V distribution); the 12,850 kVA of 1-ph., 93-cycle, 2,200-V plant generated 10,826,144 kWh (3-wire 105- and 210-V distribution); and the 540 kVA of 500-V d.c. plant generated 8,708,016 kWh (3-wire 500- and 250-V distribution). The maximum load recorded reached 34,285 kVA, and the load factor 26.1 per cent.

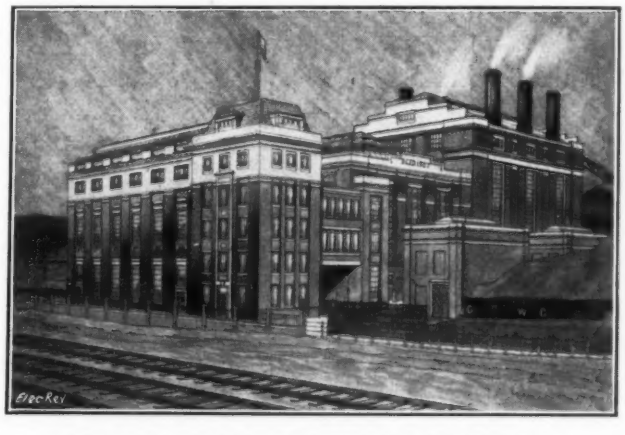


Fig. 42.—Draughtsman's Impression of Bristol's New Power House.

The Corporation's area of supply is 72.47 sq. miles and that of the North Somerset Electric Supply Co., Ltd., to which the Corporation sells energy in bulk, 443.25 sq. miles; the Keynsham Electric Light and Power Co., Ltd., was purchased in 1922. From 1924 to date loans totalling £326,423 have been sanctioned for the conversion of the distribution systems to the national 3-phase, 50-cycle standard, which sum is estimated to be about one-half of the total cost of the change of the system, and a new generating station is being built on the sea coast 10 miles from the city (of which fig. 42, above, is a draughtsman's impression, and figs. 36 to 40, pp. 987-8, are views obtained during construction); designed by the Corporation's staff, its principal novelty is the arrangement of the condensers and associated circulating water pumps and culverts.

The 23-acre site, which has a rocky foundation, is near to the Portishead docks and the Great Western Railway, and is about 2,100 ft. from the River Severn (fig. 41, p. 990). Owing to the inclination of the ground, the steel-framed, brick-filled, stone-faced buildings are terraced, the switch house being at the lowest level. Approximately 80 ft. high, the administrative block, housing also the control room, engineering workshops, &c., is being erected across the end of the buildings, as shown in the foreground of fig. 42, p. 991.

TABLE 1.—Corporation Sub-stations.

TYPE	NUMBER
Underground, 1-ph. h.p.	61
Kiosks, 1-ph. h.p.	6
Tanks and pillars	24
Transformer chambers, 3-ph. 6,000 V ...	5
Static, 3-ph. 6,000/365 V and 210 V ...	50
Rotary, 500/250 V d.c. and 6,000/365 V and 210 V 3-ph.	3
Consumers' premises (1-ph. h.p. 13 and 3-ph. e.h.p. 97)	110
Total	259

that the respective lengths of the water pipes may be so chosen as to enable full advantage to be taken of siphonic action at all states of the tide. The pump pit is 30 ft. in diameter and extends to a depth of 95 ft. below the turbine floor level; it is cast-iron lined and the condensers are each to have 18,000 sq. ft. surface of horizontal ¾-in., 18-s.w.g. tubes made of Admiralty mixture; the condensers are of the split type, which will permit of one half of each being taken out of commission for cleaning purposes without shutting down the turbines.

Steam ejectors in duplicate will extract the air, the vacuum to be maintained at the economical load being 29 in.; the duplicate condensate-extraction pumps will be motor driven, and of the pressure-glanded variety, the condensate system being closed. Cooling water at an average temperature of 55 deg. F. is to be circulated by duplicate pumps installed at the bottom of the condenser pit, where they will always be flooded and have the assistance of the siphonic action of the piping and culvert system. Being some 82 ft. below the turbine level (see fig. 44, p. 993) the pumps will be motor driven by means of vertical spindles, as all the motors driving essential auxiliary plant are being installed at a level which is above abnormal tidal floods.

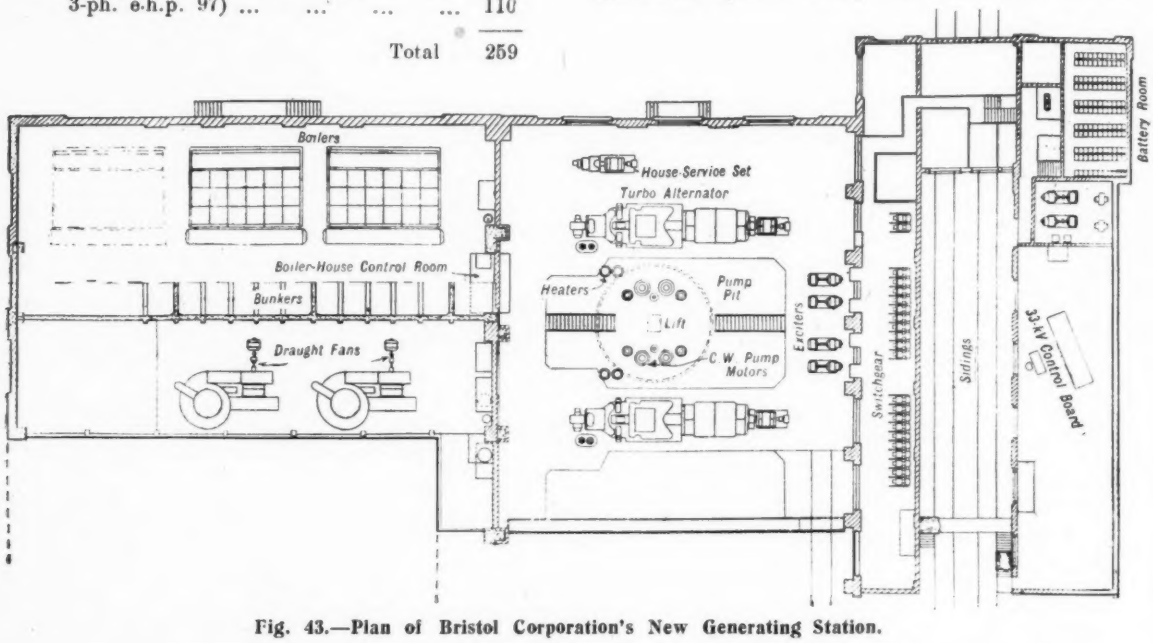


Fig. 43.—Plan of Bristol Corporation's New Generating Station.

The site is capable of accommodating appreciably greater capacity than the 280,000 kW which the station will eventually house; the first instalment of plant is to consist of two Metropolitan-Vickers 20,000-kW (m.c.r.) a.c. 3,000-r.p.m. sets. The 3-phase, 50-cycle, 11,000-volt, 0.8 power factor alternators will have closed air cooling systems with integral fans, and their slip rings will be enclosed to reduce noise. Excitation in duplicate will be furnished by two machines driven from the main sets' shafts and two others driven by separate motors; in addition, to enable the plant to be self-starting, a separate steam turbine-driven house-service set is being installed that will start exhausting to the atmosphere. This generator can also energise the low-voltage auxiliary plant switchboard, which can be fed alternatively from the main bus-bars through house-service transformers in duplicate. All the auxiliaries are to be 500-V, 3-phase, 50-cycle machines.

The main turbines are twin-cylinder impulse machines with stainless steel blading, provided with oil filters, the oil-pressure relays being operated by the governor gear; the stop-valve steam pressure is to be 300 lb. per sq. in.

The outstanding feature of the station is the unique lay-out of the condensing plant and water culverts. Figs. 43 to 45, pp. 992-3, indicate the arrangement of the plant in the station, and it will be noticed that each pair of turbines will exhaust into two Metropolitan-Vickers condensers located at a considerable depth (about 40 ft.) below the generating sets in order

The wisdom of this precaution, and the severity of the conditions that had to be complied with when designing the condenser circulating-water system, may be gauged from the fact that the maximum range of tidal variation is no less than 51.25 ft. Mr. Harley H. Dalrymple-Hay has been retained by the Corporation as consulting engineer responsible for the execution of the culvert works, for the construction of which a loan of £193,380 was sanctioned: four brick-lined 7 ft. 6 in. diameter culverts, each provided with Ledward & Beckett water screens, have been driven by mining methods right out into the River Severn (see fig. 41, p. 990) where it merges into the Bristol Channel, to a point where silting of the bed will not prove troublesome, and an adequate intake will be available at all levels of the tide. With the aid of breeches-pipe connectors and valves (indicated in fig. 45, p. 993) the direction of the water-flow may be reversed quite simply, or any culvert may be isolated for inspection; thus, each individual culvert, or combination, or group, of culverts may be utilised in turn for either suction or discharge, and the rate of discharge through any culvert increased so as to effectively scour it clean.

The boiler house (fig. 40, p. 988) is being equipped with five (with space for a sixth) Vickers independent steel-cased water-tube boilers, each having a heating

surface of 14,900 sq. ft., a normal rating of 80,000 lb. per hour, and an overload capacity of 100,000 lb. per hour. They are being fitted with Illinois travelling-grate stokers of the compartmental type of an area of 432 sq. ft. The 3,300-sq. ft. superheaters will raise the temperature of the steam to 750 deg. F. Economisers of 13,300 sq. ft. heating surface are being provided, and heaters will maintain the feed-water temperature at from 145 to 185 deg. F.; the feed system will be closed, being made up with evaporated condenser circulating water. The two evaporators will be provided with steam bled from a late stage of each turbine, and they will be each capable of providing 3 per cent. make-up. Of the boiler feed-water pumps, two are to be motor driven and two steam driven, each of 200,000 lb. per hour capacity. Each boiler will have one smoke stack, 102 ft. high from the firing-floor level; Davidson forced- and induced-draught fans are being provided and "Cyclone" grit catchers.

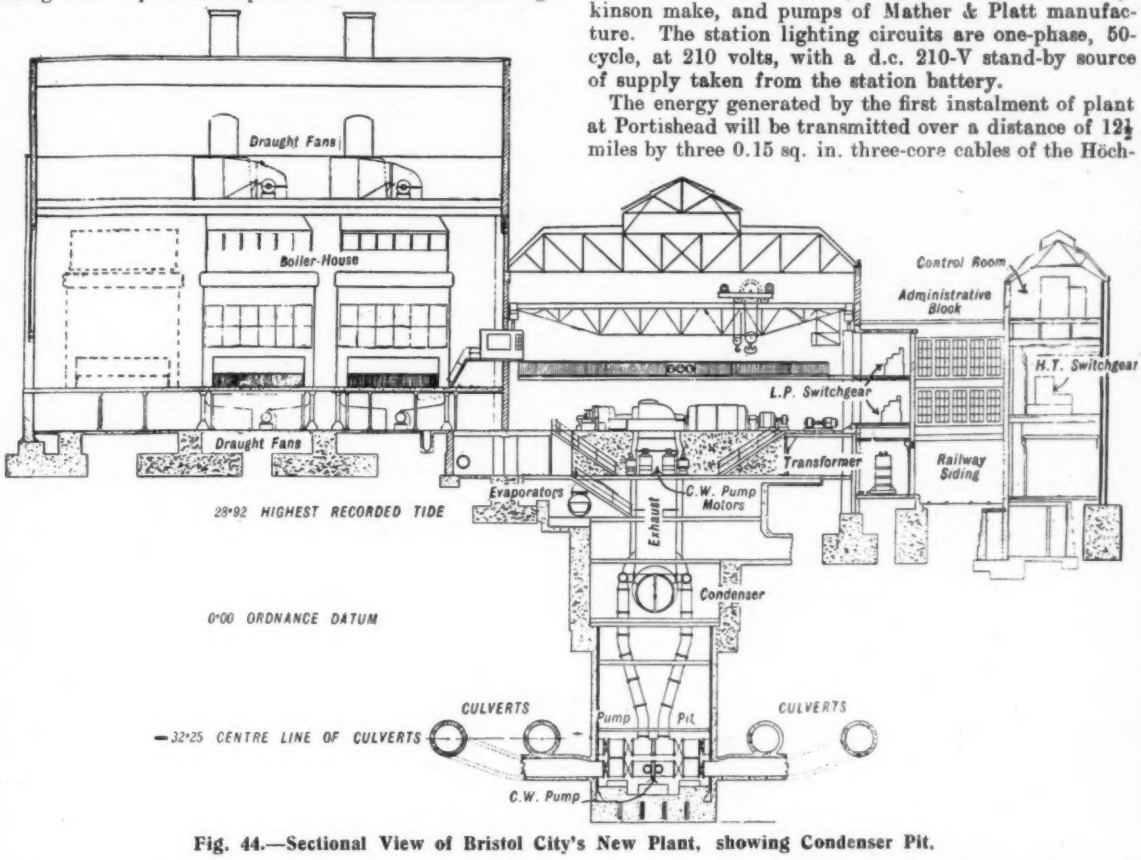


Fig. 44.—Sectional View of Bristol City's New Plant, showing Condenser Pit.

The fuel-handling plant, for which the Mitchell Conveyor and Transporter Co. is responsible, is to be capable of unloading coal at the dockside as well as at the railway sidings on the station site, and of discharging it at the rate of 100 tons per hour on to any part of the storage ground, or into the boiler-house bunkers, or from the storage ground to the bunkers direct by enclosed elevators. The ashes are to be transported by means of submerged sluices and overhead conveyors, which will discharge them into barges at the dock wharf, or into wagons on the railway sidings, or into road carts.

The generators are to be connected to Metropolitan-Vickers transformers, which will step-up the pressure from 11 to 33 kV; housed in the same building as the switchgear, they will be oil-immersed and cooled by the circulation of the oil through an external cooler. Each three-phase group will consist of three single-phase transformers of 8,333-kVA capacity each. All switching operations will be carried out on the 33,000-volt side of the transformers; the switchgear is of the Metropolitan-Vickers metal-enclosed, compound-filled, draw-out type with a rupturing capacity of 750,000 kVA, and is being installed so as to enable reactors to be inserted in the bus-bar circuits at a later date; duplicate synchronising equipment is being provided.

The switches will be remotely controlled from the control room. In view of the possibility of the station being extended by the installation of 40,000-kW, or larger, generating sets, a 100-ton Stothert & Pitt travelling crane has been provided, of the four-motor pattern with a 15-ton auxiliary hoist; all the other cranes installed are of Henderson make, all valves are of Hopkinson make, and pumps of Mather & Platt manufacture. The station lighting circuits are one-phase, 50-cycle, at 210 volts, with a d.c. 210-V stand-by source of supply taken from the station battery.

The energy generated by the first instalment of plant at Portishead will be transmitted over a distance of 12½ miles by three 0.15 sq. in. three-core cables of the Höchstädter type, which have been manufactured by Siemens Brothers & Co., Ltd. They are paper insulated, lead covered, double steel-tape armoured, jute served, and will be laid direct in the ground and protected with a concrete slab covering; pilot and telephone wires will be laid simultaneously. The cables will terminate at a new switch and transformer house which is being erected at the old Feeder Road generating station (fig. 35, p. 987) for reducing the pressure from 33,000 to 6,600 volts and interconnection with the existing three-phase distribution system.

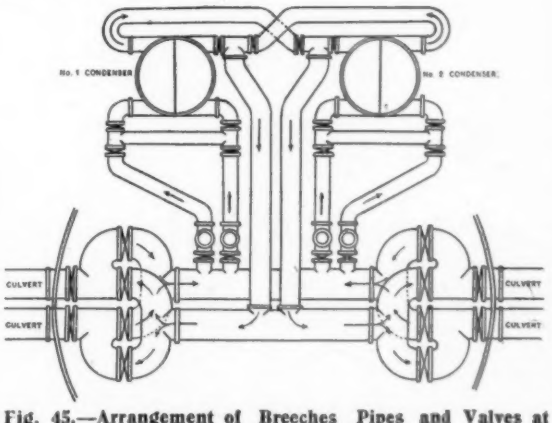


Fig. 45.—Arrangement of Breeches Pipes and Valves at Bottom of Condenser Pit.

Directional Wireless Marine Navigation.

The relative merits of directional transmission and reception are discussed, and the apparent technical superiority of the rotating beacon over the mean direction-finder is pointed out.

By R. L. SMITH-ROSE, D.Sc., Ph.D., A.M.I.E.E.

ALTHOUGH it is well known that there is no more conservative individual than the mariner, the application of wireless signalling methods to navigation is slowly but surely taking place; and it can now be said with some confidence that in a very few years' time the wireless direction-finder, or some alternative means of navigation by wireless, will be considered as essential as a compass on board every ship of any importance. Apart from just mentioning the Marconi rotating "beam," which has not proved popular owing to the short wavelength employed, and the so-called wireless course-setter which has been experimented with in Germany and America, it may be said that practical direction-finding by wireless is limited to the use of a rotating closed-loop aerial for either the transmitter or receiver.

Modern Methods.

Already a considerable number of ships of all nationalities, with those of Great Britain leading the way, are fitted with direction-finders which enable them to take bearings on wireless transmitting stations and to fix their positions with some accuracy at times when all other navigational methods fail. The several manufactured forms of direction-finder employing the principle of the plane vertical receiving loop aerial rotating about a vertical axis give an accuracy, when used under the best conditions, of the order of from 1 deg. to 2 deg. Such instruments are subject to certain errors under most practical conditions, but as a result of several years' detailed investigation the errors are now well understood, and in most circumstances they may be avoided, or compensated for, after reduction to a minimum.

With a view to avoiding the necessity of carrying somewhat elaborate direction-finding equipment on aircraft, the Royal Air Force in this country has developed a directional system in which the rotating loop is used as a transmitter installed in a fixed position on the ground. The strength of the signal radiated from such a loop varies from a maximum down to zero as the plane of the loop rotates from coincidence with the direction of the receiver to a direction at right angles thereto. If the loop transmitter is set rotating at a uniform speed, bearings may be taken by a simple timing method of observing the occurrence of the signal minimum, or zero. This rotating-beacon system was recently described before the Wireless Section of the Institution of Electrical Engineers,* and as the discussion thereon tended rather to centre on the relative merits of the direction-finder and the rotating beacon as an aid to the navigation of ships, it was considered desirable to discuss this aspect of the matter in somewhat more detail.

Relative Merits of Directional Transmission and Reception.

Location of the Direction-finder.—At the outset it must be admitted frankly that, owing to the more advanced state of its development at the present time, the wireless direction-finder when used in a fixed position on land results in somewhat superior accuracy to the rotating beacon; for it is not easy to obtain bearings on the rotating beacon to a greater accuracy than two degrees, whereas a good land d.f. station should give bearings reliable to one degree. This, however, is not the whole story, and reference must be made to the conclusions of a controversy of long standing on the matters of the location of the direction-finder, whether on ship or shore, and of the individual upon whom it is most desirable to place the responsibility of observing the bearings. Without giving the full details of this controversy, it may be stated that it is very desirable for the navigator to take the wireless bearings personally, or have the observations made by somebody under his direct control and supervision. Since the navigator is responsible for the safety of his ship, it is unreasonable to expect him to rely, particularly in emergencies, upon observations made at a shore d.f. station by a man quite unknown to him, and of whose skill and reliability he is quite unable to judge. In addition, there is the possibility of error in signalling the bearings from shore to the ship, interference with other wireless traffic in doing so, and the point of some strategic importance that the information as to the ship's bearings or position is broadcast to all wireless stations in the vicinity. It will be evident, therefore, that the most desirable position for the wireless direction-finder is on the ship itself, and this view is confirmed by the fact that during the past few years an increasing number of ships have been fitted with direction-finders, whereas the number of shore d.f. stations has never been large and is decreasing. The true comparison to be made, therefore, is between the rotating-beacon transmitter set up on shore and the direction-finder installed on board ship. In the following paragraphs the discussion of this comparison is classified according to the superiority which one system appears to have over the other.

Superiority of the Ship Direction-finder over the Rotating Beacon.—It was considered at one time that the installation of direction-finders on board ships would eliminate the necessity for special transmissions for wireless bearing purposes. This, however, has been found not to be the case, and it is now the practice to erect fixed transmitting stations, or beacons, for the sole purpose of providing special transmissions for the use of ships' d.f. sets. The beacons are usually located near lighthouses, or on light-vessels at points of importance for navigation. The use of the direction-finder is not limited to such beacons, for bearings may be taken upon the transmissions from any land station, the position of which is accurately known. It has been found, for example, that the broadcasting stations form very useful fixed beacons operating for many hours of the day, when it is desired to take wireless bearings on a ship at sea. The navigator with a direction-finder under his control thus has the opportunity of taking a series of cross-check bearings and so of improving the accuracy of determination of his position.

A further advantage of the ship fitted with the d.f. set is that the opportunity is provided for observing bearings upon the transmissions from other ships. This may be useful when contact is made with a ship which knows its own position, but it is of greater importance when applied to the location of ships in distress, as has already been demonstrated in several practical cases. Moreover, there is the possibility that the future development of the ship direction-finder will provide a means for reducing, or avoiding, collisions between ships in foggy weather.

These advantages are not possessed by the rotating-

* Elec. Rev., January 20th, 1928, p. 128.

beacon system, which provides ships with opportunities of obtaining bearings only during the operation of such beacons, and in those areas of the world in which the beacons are installed. The navigator with a d.f. set under his immediate control would probably use it very frequently and would thus soon become aware of the occurrence of any fault or error. In the case of the rotating-beacon system he is dependent upon information from the shore-station staff as to any such errors; but against this it may be urged that such a staff would be more expert at dealing with and removing the error than would the average navigator or wireless operator.

Superiority of the Rotating Beacon over the Ship Direction-finder.—By way of countering the remarks made in the above section, it may be said that the rotating-beacon transmitter retains all the advantages which were sacrificed when the d.f. installation was moved from the shore to the ship. These advantages comprise the fact that the directional part of the system is fixed in position on solid ground and that it can, therefore, be accurately oriented and calibrated at installation, and also that it can be under the continuous supervision of experts. One directional shore station will provide service to an almost unlimited number of ships, whereas each ship's direction-finder must be carefully installed and operated by experienced men.

One of the great advantages of the rotating-beacon system is that no apparatus beyond a simple wireless receiver and a chronograph is necessary on the ship itself; a direction-finding service is thus provided for ships of all classes, from the largest to the smallest. In the case of many small ships it would not be practicable to install a direction-finder with any pretence to accuracy; and to the large ship already fitted with a d.f. set, a rotating beacon would be an additional asset in enabling further bearings to be taken either for check purposes or for position determination. Furthermore, the method of observing bearings is so simple that they can easily be determined by the navigator himself in any portion of the ship without necessarily requiring the assistance of a wireless operator.

It has already been hinted that the accuracy of bearing observation by direction-finder on a ship at sea is less than that obtainable with a similar installation on land. The difference is, in fact, sufficient to make the optimum accuracy of the ship direction-finder comparable with that of the rotating-beacon system. The d.f. bearing is taken relative to the direction of the ship's head, and its accuracy depends upon the steadiness of the ship and also upon the accuracy with which the direction of the ship's head is indicated by the compass reading at any desired instant. In anything but a calm sea it is difficult to keep the head of a small ship steady within one or two degrees, and in a rough sea the swing may amount to five degrees or more; also there is probably a lag between the actual direction of the ship's head and the reading of the compass, whereas no such lag exists on the direction-finder. The bearing obtained from the rotating beacon is entirely free from these limitations, and its accuracy is practically the same whether the ship be at sea or in dock. Also, since the accuracy of observed bearings has been shown to be largely immune from conditions local to the receiver, no correction or compensation is necessary corresponding to the quadrantal error associated with the ship direction-finder. This error is likely to be serious in the case of many small ships, and there is the added possibility of its alteration with draught and nature of cargo.

The limitation of range of accurate bearings due to night effect has been shown, both theoretically and experimentally, to affect both systems of directional wireless to the same degree. The accuracy of the rotating beacon has also been found to be sensibly the same for both continuous-wave and interrupted-continuous-wave transmission. Considering the possibility of interference between rotating beacon transmitters and other wireless services, a similar objection may be raised to the fixed-beacon transmitter which has been found to be so necessary in conjunction with the ship direction-finder. In neither case, however, is any serious interference likely to be caused, since definite and distinct wavelengths have now been allocated to both types of beacon.

A small point just worthy of mention in concluding this section, is that rotating beacons erected on the coast would be of some considerable service to aircraft navigators, particularly those making daily flights along the principal air routes.

Conclusions.

It will be gathered from the above discussion that the rotating-beacon system is considered to have some advantages over the ship's direction-finder in the application of directional wireless to marine navigation. These advantages are, however, probably not sufficiently well defined at present as to make the future policy of those concerned with these matters independent of certain other factors; and in any case it is evident that the economics of the situation must be considered as well as the technical features.† The rotating-beacon system would at first appear to be economical in that the whole cost of the directional apparatus is removed to the authority controlling the shore stations, and it is to be presumed that the cost of installing and maintaining the rotating beacons would be met by the levy of a tax upon all ships using the beacons. This might be a great advantage to shipowners, who, judging from their tardiness in equipping their ships with direction-finders, do not appear to find this apparatus very cheap. To the cost of such direction-finders, moreover, must be added that of the fixed beacons specially built for their use. This cost depends upon local conditions and whether or no the beacon can be installed at an existing lighthouse and maintained by the *personnel* of the lighthouse. The first rotating beacon for practical working to ships has yet to be built, so that details of its cost are at present unknown.

In view of the apparent technical advantages possessed by the rotating beacon, it is to be hoped that this system will be given a fair trial in competition with its elder brother, the marine direction-finder, before the economics of the situation are too closely studied.

† ELEC. REV., May 4th, 1928, p. 798.

Legal.

Electricity Supply Company's Claim Against a Club.

AT the Greenwich Police Court recently the South Metropolitan Electric Light & Power Co., Ltd., summoned Mr. M. J. Robertson, secretary of the Drive Club, Sydenham, to recover £12 7s. 3d. for electricity supplied to the club.

The defendant pleaded that the company could not hold either himself or any individual member of the Club responsible for a club debt. The magistrate (Mr. Powell) agreed with this and said that the company would have to proceed against the club.

An Unguarded Electric Fan.

AT Scunthorpe, on May 30th, the Appleby Iron Company (Scunthorpe), Ltd., was fined £25, with 17s. 6d. costs, for a breach of the Factory Acts by having in use an electric fan improperly guarded. The case arose out of an accident on May 3rd, when a workman employed in greasing had his arm broken by its being drawn into the fan.

Electric Wiring Dispute.

THE *Sussex Daily News* reports that at the East Grinstead County Court recently, before Judge Owen Thompson, Messrs. Mitchell Bros. claimed from Mr. Maurice Greenhill, Hartfield, the sum of £36 for work done and material supplied.

Mr. E. J. MITCHELL, a partner in the plaintiff firm, said that he was working on a contract on defendant's farm in August and September last and in the course of this had to remove some floor boards. He found that some electric wires beneath these were bare and the boards were charged and upon drawing the defendant's attention to this was told to make the installation safe. He found that every circuit but one was

defective; there were 82 points, of which he re-wired 77. Later defendant told him that he had done too much and refused to pay for more than 38 points.

Giving evidence, the defendant admitted instructing the plaintiffs to do some work, but maintained that Mr. Mitchell had "taken possession" and had done far more than he required to be done. He had never asked for an estimate because he did not want the work done.

His Honour said that of the conflicting evidence he decided to accept the plaintiff's. He accordingly gave judgment for the amount claimed.

Breach of Factory Regulations.

The *Birmingham Post* reports that the Michelin Tyre Co., London, was fined £25 by the Potteries Stipendiary at Stoke-on-Trent, on June 1st, for neglecting to have a switchboard made "dead" while work was being done on it, with the consequence that a workman suffered injury. The firm was fined another £5 for failing to notify an accident. The case, which was brought on the instructions of the Director of Public Prosecutions, was that a man named Robert Cowley, of Moss Side, Manchester, was working on a switchboard at the company's factory at Stoke-on-Trent, when he received an electric shock and was badly burned. It was alleged that there was a breach of the factory regulations in not having the switchboard properly screened.

Reviews.

A Text-Book of Telegraphy, Theoretical and Practical. By A. E. Stone, A.R.C.Sc. Pp. vii+455; figs. 386. London: Macmillan & Co., Ltd. Price 20s. net.

Apart from the successive editions of the older works on the subject of telegraphy which have appeared from time to time, mainly with the object of providing students with the material necessary for passing the examinations of the City and Guilds of London Institute, the need for a new text-book does not appear to have been felt. Unlike its sister subject, telephony, its development has been comparatively slow, and the advances in apparatus and systems have been described from time to time in special papers read before one or other of the electrical societies. These advances are incorporated to a greater or less extent in this new volume.

The work consists of 23 chapters and two appendices, and deals with Fundamental Phenomena; Batteries; Ohm's and Kirchoff's Laws; Galvanometers; Electromagnetism and Induction; Electrostatic Capacity and Condensers; Measurements; Single Current, Double Current, and Duplex Telegraphy; Central Battery Working; Quadruplex; Wheatstone Automatics and Repeaters; Type Printing Systems; Superposition; Line Construction; Testing of Lines; Submarine Cable Telegraphy; Alternating Currents and Propagation of Signals along Lines; Radio Telegraphy, &c.

The two appendices consist of a short chapter on voice frequency telegraphy, and a table of exponential and hyperbolic functions.

It has been the invariable practice of those who have written books on telegraphy, from the classical work of Culley onwards, to introduce the subject by enunciating a number of elementary facts and definitions which must be well known even to those students who take up the subject of telegraphy for the first time, and this volume is no exception to the rule. Much of the work is necessarily a repetition, in one form or another, of what has been written on the subject since the issue of the classical work referred to, and it is not until the chapter on type-printing telegraphs is reached, that we really come into touch with the aspects of modern telegraphy. Although an effort has apparently been made to retain as little as possible of what is now obsolete, or obsolescent, one cannot help feeling that the subjects of submarine telegraphy and radio-telegraphy might have been considerably expanded at the expense of less important matter, even although, as stated by the author, these subjects can only be fully dealt with in special manuals. In the 74 pages dealing with type-printing systems the author has introduced descriptions of the various arrangements adopted in this country, from the simple Steljés apparatus to the latest form of start-and-stop system, with, in most cases, lengthy detailed descriptions of the mechanical and electrical actions involved in their operation.

The treatment of alternating currents and propagation of signals along wires is of the usual type now adopted in text-books on these subjects. Worked examples are also given to illustrate the use of the formulæ. In the chapter on "Theory of Submarine Cable Transmission," page 421, the phrase "*transition* theory of transmission" is used. What is meant is probably the "transient" theory of transmission. Again, on page 435, "Lu De Forest" should, of course, be "Lee De Forest."

On page 148 the "non-polarised" relay is shown with its contacts lettered "S," "M"; the former being to the left. As a matter of fact the "S" contact is the marking contact of this type of relay except when employed in decrement working. Again, in discussing the Quadruplex "B kick,' figure 155 does not appear to be in accordance with the text, where it is stated that "the ordinates *aa'*, *bb'* will be further to the *right* and *left* respectively." The words italicised should be interchanged. There is also a noticeable lack of uniformity, throughout the book, in the way in which the coils and contacts of the relays are shown in relation to the tongues. In some cases the tongues are shown pivoted remote from the coils, in others they are pivoted near them, whilst in yet other cases the tongues are omitted altogether.

Treating the work as a whole, those students who are preparing for examinations, and for whose needs the book has been written, will, by judicious discrimination of what is essential to their purpose, find sufficient material within its pages to furnish them with a fairly adequate knowledge of telegraphy.

Classified Examples in Electrical Engineering. Vol. I, Direct Current; Vol. II, Alternating Current. By S. Gordon Monk, B.Sc., A.M.I.E.E. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. net (Vol. I), 3s. 6d. net (Vol. II).

These volumes are collections of questions which have been set in electrical engineering examination papers during recent years in connection with the London B.Sc. degree in engineering, the A.M.I.E.E., City and Guilds, and Whitworth examinations, with answers at the end of each volume; the questions are classified under sectional headings, and in many of the sections brief notes are given for the guidance of the student. In some cases examples are fully worked out, and references are given to sources of information on the subjects dealt with. Vol. II is more advanced than Vol. I, and whilst it deals mainly with alternating current, it is not confined to that subject, many of the questions being equally applicable to both a.c. and d.c. systems. The questions cover a very wide field, and should be of great value to students, who benefit immensely by working out such problems. They occupy 68 pages in Vol. I, and 94 in Vol. II. Lecturers also will find these collections useful, supplementing the problems devised by themselves.

Actinotherapy. By H. G. Falkner, O.B.E. Pp. x+152; 36 figs. London: Baillière, Tindall & Cox. Price 7s. 6d. net.

The author, actino-therapeutist to the London Teachers' Association, has written this book mainly for general practitioners who desire to improve their acquaintance with this comparatively new healing agency, a task for which his own extended experience admirably fits him. It is therefore of a thoroughly practical nature, and includes valuable advice on the choice of apparatus. The author, whilst pointing out that the ultra-violet ray is not a panacea, is clearly an enthusiastic advocate of its use in suitable cases. After briefly reviewing the history of the subject, including, of course, natural sunlight, he explains the characteristics of the various forms of "lamp" available—some of which are of his own design—with numerous illustrations. We are pleased to note that he strongly recommends the use of the spectroscope for checking the output of a lamp, as well as the actinoscope for measuring the quality and quantity of the ultra-violet rays. The properties of quartz and glass are dealt with, after which the author turns to the physiological effects of the rays, and devotes 15 of the 23 chapters to dosage, technique, and the detailed treatment of diseases and disorders over a very wide range. The book should be of great assistance to those who are interested in the subject from a professional point of view.

The House of the Lighted Window. By Gladys F. Sharp. London: Eveleigh Nash & Grayson, Ltd. Price 7s. 6d. net.

This is the story of one of those brilliant young men, so full of promise, who returned from the war sightless nerve-shattered wrecks. Lorraine Sinclaire exiles himself with his devoted sister in a little Devonshire seaside village, to rest his nerves and to await his fiancée, Joan, who in Stockholm is relaxing after her strenuous work as a V.A.D. There she meets her ideal, a handsome young officer in the blue and gold uniform of the Swedish army. Torn between compassion for Lorraine and love for Hugo, she returns to England and to what she firmly believes is her duty. Chance and a motor accident bring Hugo and his devoted friend to the little Devonshire retreat of the Sinclaires, and there decisions are made that alter the lives of five young people.

The story is simply and sympathetically told, the Stockholm scenes especially being bright and full of colour. Hugo's charming stepmother forms a contrast to Mrs. Sinclaire, whose unnatural lack of sympathy for her blind son strikes a harsh note in a pleasant book. Miss Sharp, whose first novel this is, belongs to the Electrical Association for Women, and is a daughter of Mr. E. E. Sharp, of Venner Time Switches, Ltd.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Electrical Refrigeration.

The report of the E.D.A. Sub-Committee on Refrigeration which was published last week is a very concise statement of the position in this country of electrical refrigeration and its future prospects. The various types of refrigerators available have been studied and the particular merits of each are set out. Questions which are likely to be asked by the prospective customer are anticipated by statements regarding reliability, capacity, initial and running costs, power consumption, &c. It is shown that a refrigerator load is likely to exceed the lighting load, while being far superior to lighting from the supply undertaking's point of view. The necessity for some system of hire-purchase, both for domestic refrigerators and larger models, is stressed. The Committee, after reviewing all the matters investigated, strongly recommends a campaign for the encouragement of the use of British electrical refrigerators. It is mentioned that the Electrical Refrigerator Section of the British Electrical and Allied Manufacturers' Association promised an immediate special donation towards this campaign, and in an appendix very full details are given of the British refrigerators made by the following companies:—Robert Boby, Ltd. ("B.B.R."), Electrolux, Ltd., Freezone, Ltd., J. & E. Hall. Ltd. ("Hallmark"), the General Electric Co., Ltd. ("Magnèt"), and Marco Refrigerators, Ltd.

With this report we have received a set of samples of the propaganda matter which has been produced in connection with the Campaign. These have been produced to make separate appeals to the housewife, the butcher, the florist, the dairyman, and hotels, restaurants, cafés, boarding houses, &c. There are a number of attractive coloured folders telling a plain straightforward story and a set of model letters addressed to particular classes of "prospects." There are also complete newspaper advertisement "layouts," blocks for which can be provided by the Association free of charge. The principal production is a window display, supplies of which were practically exhausted a week ago.

B.E.A.M.A. and the Tokio Loan.

According to the daily Press, the British Electrical and Allied Manufacturers' Association issued a statement last week in connection with the loan being raised in London by the Tokio Electric Light Co. It was said that in the past the Tokio Company had raised loans in this country to the extent of £3,600,000, and so far as the Association knew not a single order had been placed in this country by the company. Thus, from the point of view of British industry, that issue of capital had no value whatever. "It supplied a Japanese electric power company with financial resources which benefited foreign manufacturers, and was, therefore, a direct loss to British trade." The view was expressed that in return for the additional capital supplied to it by the British investor the company should undertake to allocate a corresponding proportion of its orders for generating plant and equipment to the British electrical industry. "At a time when every possible incentive should be given to industry to improve its manufacturing and competitive equipment, the diversion of capital away from the British industry must be regarded as against the national interest." The statement concluded with an expression of the ability of British electrical manufacturers to carry out any power plant contracts efficiently and satisfactorily.

The Times, in its editorial financial comments, criticised the statement, suggesting that the Association might have found a better case upon which to base its claim, seeing that the present issue is so largely a purely financial operation.

The Contractors' Hire-Purchase Scheme.

According to the *Electrical Contractor*, the final meeting of the Hire-Purchase Committee of the Electrical Contractors' Association has been held, and as a result of the voting by the seven signatories appointed by the Council, three directors, namely, Mr. W. H. Walton, Mr. W. Riggs, and the chairman of the Trading Committee, have been appointed.

The E.C.A. and Registration.

The *Electrical Contractor* reports that at the April meeting of the Council of the Electrical Contractors' Association the secretary (Mr. L. C. Penwill) stated that in view of the recent article in the ELECTRICAL REVIEW (March 30th, p. 542) and the growing controversy as to the utility or otherwise of the National Register of Electrical Installation Contractors, it might be advisable to reconsider the scheme for guaranteeing the work of members of the Association, which had been discussed some years ago. He suggested that details of the scheme be sent to members of Council and that the matter be discussed at the next meeting.

At the same meeting attention was drawn to the fact that there were electrical contractors in Manchester who described themselves as "registered contractors" because many years ago the Manchester Corporation had formed a register of contractors. The president (Mr. W. A. Shaw) said that he had taken up the matter, but was informed that nothing could be done until the firms in question went out of business. He was of the opinion, however, that the matter might be again raised with the Registration Authority.

At a meeting of the Potteries Branch of the E.C.A. a discussion upon registration took place. Reference was made to the small amount spent by the Authority in publicity matters. Members were recommended to advertise registration themselves and to obtain from the Registrar the leaflet which should be sent with all tenders.

Italian Foreign Electrical Trade.

The appended table gives the value of the Italian imports and exports of electrical machinery, apparatus, and cognate goods during the first three months of the current year, as compared with the corresponding period of 1927. It will be noticed that the 1928 totals both show reductions; taking the exchange value of the lira at 92.60 to the £, the imports declined from £826,640 to £730,025, and the exports from £202,752 to £143,505.

	Imports. Jan. to Mar.		Exports. Jan. to Mar.	
	1928. Lire.	1927 Lire.	1928. Lire.	1927. Lire.
Accumulators ...	571,100	230,500	1,391,700	2,003,200
Battery parts ...	11,100	216,200	12,400	102,600
Electric lamp bulbs	901,300	588,600	—	—
Electrical measuring instruments ...	582,200	581,800	11,600	7,200
Other electrical instruments	12,784,900	12,152,400	2,624,500	1,987,700
Radio apparatus ...	5,210,000	4,122,200	384,200	675,200
Telephone and telegraph apparatus ...	14,463,709	27,768,000	301,600	694,700
Electric furnace carbons	1,988,200	3,430,800	177,400	259,500
Lamp carbons ...	436,800	311,800	16,800	2 600
Electric cables ...	1,307,200	675,800	1,002,500	2,858,000
Electricity meters...	3,355,100	3,950,000	12,200	222,400
Insulated wire ...	738,900	849,800	1,258 900	1,699,200
Generators	11,958,800	9,955,800	4,362,800	7,189,700
Porcelain insulators	1,108,900	1,679,500	137,600	78,300
Glass insulators ...	26,800	81,100	1,000	1,600
Arc lamps	5,200	52,600	—	—
Incandescent lamps	10,785,100	7,105,500	1,426,400	610,200
Static transformers	1,457,200	2,328,500	267,800	356,500
Insulating tubes ...	7,900	11,900	75,900	26,300
Totals, Lire	67,700,400	76,146,800	13,455,300	18,774,900
£	730,025	826,640	145,305	202,752

Electricity in Council Houses.

In the houses erected by the Greenock Corporation, with the approval of the Scottish Board of Health, electricity has been installed. A few of the tenants asked that gas might be substituted for electricity, and the Council accordingly communicated with the Board of Health. The Board has replied that the proposal is not one which it is prepared to approve. The Council has decided to take no further action in the matter.

Removal of Petters' Ipswich Business.

As it has been thought that the note which appeared under this heading in our issue of May 25th (p. 908) did not give a complete indication of the future intentions of the directors of Messrs. Petters (Ipswich), Ltd., we may say that production is to be continued at Ipswich until the end of the year. The position thereafter is explained in the following notice, issued, under date May 17th, to customers and others:—

"The directors of Petters (Ipswich), Ltd., have decided to remove the business from the present works, and are making

arrangements for the manufacture at Yeovil of the range of heavy oil engines hitherto made at Ipswich.

"In consequence of this decision, the work hitherto carried on here will cease about the end of the present year, and the Ipswich works are for disposal.

"There will be no break in continuity of manufacture or in the ability to obtain replace parts for engines manufactured at Ipswich."

New Showrooms at Barking.

The new showrooms of Barking Urban District Council were formally inaugurated by the chairman of the Council on May 31st. The building, which is centrally situated, is of three storeys and occupies a frontage of 30 ft. It is constructed of red brick, the front being faced with stone. Four lamps mounted on stone pedestals are erected above the entrance, on

The New Showrooms at Barking.

either side of which are two show windows. The walls of the showroom are of panelled oak, mounted with a white dado, and this room is confined to the display of domestic appliances. Lighting fittings of various designs are suspended from the ceiling. The rear of the building is set aside for stores, and ample accommodation for the electrical engineer (Mr. W. Holmes) and his staff is provided on the first floor. The second floor is used by the sales superintendent as domestic accommodation. The building was constructed to the design of Mr. C. J. Dawson. During the first 22 years of the undertaking the net losses amounted to £27,249, but during the last six years profits totalling £23,293 have been shown. The scale of charges was reduced in January last, and the average price now charged is below the pre-war rate. With such favourable conditions, the new showrooms should assist materially in stimulating the demand for electricity for domestic purposes.

The New Rating Proposals.

Mr. Michael Faraday, F.A.I., will address the members of the British Engineers' Association on "The New Rating Proposals and their Benefits to Industry," at the monthly luncheon meeting of the Association which will be held at the St. Ermin's Restaurant, Tothill Street, Westminster, on Thursday, June 14th. Representatives of engineering firms who desire to be present can obtain particulars from the secretary of the Association at 32, Victoria Street, London, S.W.1.

United States Foreign Electrical Trade.

The exports of electrical equipment from the United States during March reached a value of $9,668,279, as compared with $8,668,079 in March, 1927. The increase was general and very few decreases were recorded in the various classes. The greatest rise appears to have occurred in switchboard panels (except telephone), exports of which were valued at $222,124, against $95,197 in March, 1927. Railway motors rose from $37,130 to $175,489, and refrigerators up to 1-ton capacity from $303,957 to $417,153. Other notable increases were registered by all classes of batteries, d.c. generators, radio apparatus, and domestic washing machines. There were large decreases in unspecified apparatus (from $829,310 to $624,940), switches and circuit-breakers over 10-A (from $230,130 to $120,911), telephone equipment and railway signalling apparatus. Canada, as usual, was the best customer, taking $2,150,849 of the total (22 per cent.). Great Britain, with $766,900, occupied second place, being closely followed by Japan ($755,772). Other important markets were Argentina ($641,556), Mexico ($560,607), Australia ($528,907), and Brazil ($497,588). The increase in the United Kingdom's share of $254,932, as compared with February, is accounted for by larger shipments of generators, motor parts, vacuum cleaners, portable tools, and radio accessories.

Imports of electrical apparatus into the United States during March were valued at $243,102, consisting principally of electrical machinery and parts ($99,897), electric lamps ($70,758), and electrical apparatus and parts ($50,318). The bulk of the machinery and apparatus came from Sweden and the lamps from Japan.

Electrolux Developments.

The Swedish Press reports that Col. Wernher, the chief of the English branch of the Swedish Electrolux Co., stated that his recent visit to Sweden was concerned principally with the formation of the proposed English daughter company in consequence of the great development of Electrolux activities in this country. He said that the controlling interest in the English company would remain in Swedish hands.

New French Companies.

A new company, the Société Lorraine-Champagne de Transport et de Distribution d'Energie Electrique, recently registered in Paris (54, Rue la Boetie), with a capital of 12 million fr., is to organise an electricity supply distribution system in the Lorraine and Champagne districts.

La Société Nouvelle des Constructions Téléphoniques (Brevets Tchoubritch-Dorval) has lately been formed in Paris, with a capital of 3,000,000 fr., to exploit the Tchoubritch-Dorval telephone patents. Another company which has recently been formed in Paris is the Société des Applications Electriques Téléphoniques et Radiotéléphoniques (14, Rue Beaurepaire), to manufacture telephone and radio apparatus.

A Large American Merger.

The *Electrical World* gives particulars of the scheme for the merging of the undertakings of the Consolidated Gas Co. of New York and the Brooklyn Edison Co. The Consolidated Gas Co. will acquire the Brooklyn Edison stock giving one common share and one $5 preferred share for each Brooklyn Edison common share. The total assets of the two companies at the end of 1927 were stated to have a value of $1,012,000,000, of which the Consolidated Gas Co. possessed $840,000,000. During 1927 the Consolidated Gas Co.'s concerns sold 2,320,531,525 kWh, while the Brooklyn Edison sales were 754,635,609 kWh.

New Catalogues and Lists.

MESSRS. S. WOLF & CO., LTD., 115, Southwark Street, S.E.1.—A priced and illustrated booklet dealing with electric drills and grinders, portable and bench patterns.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—An illustrated folder containing particulars of the company's electric washing machine and wringer.

BAKELITE, LTD., 68, Victoria Street, S.W.1.—A pamphlet illustrating examples of "Bakelite" gears and pinions.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Catalogue 160, Section X, containing illustrations and dimensions of mining type cable boxes—junction, dividing, disconnecting, gate-end, &c.

MESSRS. JULIUS SAX & CO., LTD., 27, Lower Mall, Hammersmith, W.6.—A comprehensive illustrated and priced catalogue of electric bells and buzzers, indicators, relays, pushes, alarm contacts, resistance coils, flexibles, bell transformers, dry cells, plugs and sockets, lampholders, lighting fittings, and other accessories.

AUTOMATIC & ELECTRIC FURNACES, LTD., North Road, Holloway, N.7.—Heat Treatment Bulletin No. 40.—"High-Speed Steel," by A. R. Page, metallurgist to the Birmingham Small Arms Co., Ltd.

MESSRS. A. H. HUNT, LTD., Tunstall Road, Croydon.—A comprehensive illustrated price-list of "Hellesen" dry batteries for radio purposes, &c., and portable lamps of various patterns.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—June price list of electrical plant, appliances and accessories, including motors and dynamos, domestic appliances, switchgear, &c.

June calendar-blotters have been received from the JACKSON ELECTRIC STOVE CO., LTD., MESSRS. MAVOR & COULSON, LTD., MESSRS. J. G. STATTER & CO., and POPE'S ELECTRIC LAMP CO., LTD.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.1.—A folder containing brief illustrated particulars of the "Selco" domestic refrigerator. Priced.

ELECTRIC FIRES, Heatrae Works, Norwich.—Catalogue Section C, Sheet 3, containing illustrations, particulars, and prices of electrically-heated towel rails.

THE REVO ELECTRIC CO., LTD., Britannia Works, Tividale, Tipton, Staffs.—Catalogue No. F.7, containing illustrated particulars of many examples of the company's electric fans, including the "Elite," a novel design for domestic use. Priced.

MESSRS. JAMES TATE & CO., Victory Works, Bradford.—An illustrated booklet fully describing the firm's system of electrical operation of valves.

MESSRS. A. EMANUEL & SONS, LTD., 9-13, George Street, Marylebone, W.1.—A net trade price list of electrical accessories, including wiring materials, bells, &c.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A well-bound catalogue (123 pp.) of "Sterling" products for which the company is sole agent. The publication covers telephones, electric bells and signalling apparatus of many patterns.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet V.4291, illustrating the "Magnet" Type 5 refrigerator (44 cu. ft. capacity).

MESSRS. J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham.—A list containing reduced prices of the company's tumbler switches.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue No. P.231, containing full details and illustrations of "Prescot" butt-welding machines for a variety of purposes.

YESLY ELECTRICAL SUPPLIES, LTD., 5, Iliffe Yard, Crampton Street, S.E.17.—An illustrated price-list of Mansbridge type condensers for radio purposes, &c.

Bankruptcy Proceedings.

S. J. SEWELL and W. L. BROWN, trading as Sewell & Brown, electrical and radio engineers, 6a, The Exchange, Muswell Hill, N.—The first meeting of creditors was held on May 30th, at the London Bankruptcy Court, the debtors having filed their petition on May 16th. According to statements made by the debtor Brown in preliminary examinations, he was formerly employed as a salesman by Burndept Wireless, Ltd. In September, 1926, he and the debtor Sewell, with a capital of £300, borrowed from Brown's father, began to trade as electrical and radio engineers at Muswell Hill. A further loan was afterwards obtained from his father, to whom there is now due, including interest, £428. The business expanded, and in March of last year they took additional premises. During the past few months there has been a great falling off in the demand, and the firm has been handicapped by a lack of working capital, and difficulty experienced in collecting outstanding accounts. On May 11th the Marconiphone Co., Ltd., a judgment creditor, levied execution for £52. The sheriff's officer also entered into possession for the balance of the debt due to another creditor. On the solicitor's advice the debtors filed their petition in order to protect the general body of their creditors. The debtors roughly estimated their liabilities at £1,000, and valued their assets at £300. The estate was left in the hands of the Official Receiver to be wound up in bankruptcy.

H. H. SPEKE, 12 to 17, Bilston Street, Wolverhampton, Staffs., electrician.—The receiving order in this case was made recently on the debtor's own petition. The first meeting of creditors was held on May 23rd at the Official Receiver's Office, Wolverhampton. Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham, was appointed trustee on May 30th. The following are among the creditors:—

	£		£
Burndept Wireless, Ltd.	74	Smith & Bellhouse ...	32
Houghton - Butcher (G.B.), Ltd.	44	Seley & Co.	45
Hobbies, Ltd.	45	Teubkin, J.	28
Hearn Electric Co. ...	39	Universal Electric Lamp Co.	25
Kemp Mills, Ltd. ...	26	Wolverhampton Electricity Dept.	48
Small, Mrs. C.	150	"Z" Electric Lamps and Supplies Co., Ltd.	40
Marconiphone Co., Ltd.	20		
Marshall & Co.	33		

H. WAGG, dealer in radio goods, late of 12, Holborn Viaduct, E.C.—The first meeting of creditors was held on May 31st at the London Bankruptcy Court, a receiving order having been made on May 17th at the instance of a creditor. According to the debtor's statements in preliminary examination he has been interested in various business enterprises, the last being a verbal partnership with another person with whom he carried on business as dealers in radio goods under the style of Wagg and Pullen. They carried no stock, buying and selling as and when they obtained orders, and the partnership lasted 18 months. His partner disappeared some weeks before the business was finally closed and debtor was unaware of his present address. The debtor states that his liabilities do not exceed £200, and that the claim of the petitioning creditor relates to money borrowed on the security of a patent of which he was the owner. He attributes his insolvency to general depression in trade, to keen competition, and to insufficiency of capital. His assets consist of book debts of the value of £40. The Official Receiver will wind up the estate in bankruptcy.

J. EADE (J. Eade & Son), electrical contractor, 48, New Road, Skewen, Glamorgan.—Last day for proofs for dividend June 12th. Trustee, Mr. W. G. Board, 12, Fisher Street, Swansea.

A. J. GARROD, manufacturer of radio sets, George Street, Wellingborough.—First and final dividend of 9d. in the £, payable June 4th at the offices of Messrs. Heygate & James, Church Street, Wellingborough.

W. A. HAMMOND, wireless dealer, 31, Middle Street South, Great Driffield.—Receiving order made May 25th, on debtor's own petition.

A. L. ASTILL (Eastern Wireless Supply Co.), wireless engineer, 362, High Street, Lincoln.—First meeting June 9th, at the Official Receiver's office, 10, Bank Street, Lincoln. Public examination July 5th, at the Sessions House, Lincoln.

H. A. PRATT, electrical engineer, Essex House, Lee Road, Dovercourt.—Last day for proofs for dividend, June 16th. Trustee, Mr. H. S. Gotelee, Official Receiver, 9, Arcade Street, Ipswich.

F. H. BARRELL (F. H. Barrell & Co.), electrical and radio engineer), 2a, 2b and 2c, Church Street, Staines.—Last day for proofs for dividend, June 15th. Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C.1.

H. D. DOUGLAS (H. D. Douglas & Co.), wireless factor, &c., 32, Queen Victoria Street, E.C.4.—First and final dividend of 8½d. in the £, payable June 11th, at 4, Charterhouse Square, E.C.1.

W. H. WILSON, electrician, 1, Bryn Terrace, Ruabon.—First and final dividend of 4s. 11d. in the £, payable June 15th, at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

Company Liquidations

STUART LAIRD, LTD., electrical and wireless dealers and manufacturers, Great Chapel Street, W.1.—The statutory meeting of creditors was held on May 31st, at Winchester House, Old Broad Street, E.C., when Mr. D. Weller (Palatine Trade Protection Office) was elected to the chair. Mr. H. F. Inkson, 23, King Street, Cheapside, E.C., submitted a statement of affairs which showed ranking liabilities of £1,821 and net assets of £842, leaving a deficiency of £979. The issued capital of the company was £900, and as regarded the shareholders there was a deficiency of £1,879. The company was registered in November, 1926, with a nominal capital of £1,000, to carry on business as general dealers in wireless and electrical equipment. The first directors of the company were Messrs. S. A. Laird and E. H. Flower. Prior to the formation of the company, Mr. Laird acted as the London representative for a Manchester firm. He continued in that capacity, but under his service agreement with the company he ceded to it any payments or benefits which he received from his principals. Accounts had been prepared at various dates, the last being at March 3rd last. That balance sheet disclosed a serious state of affairs, and, acting on the advice of the accountants, the usual resolution for voluntary liquidation was passed. Up to March 3rd last the net loss on the trading had been £723. The liquidator said that, in his opinion, the present position was due to the fact that there was not sufficient working capital available to allow the usual amount of credit to customers, and at the same time provide a sufficient margin of cash to obtain the most favourable terms for buying, and to pay overhead expenses. The purchases had amounted to £16,687, against sales of £17,022. There was a gross profit on the trading of £920, but after allowing for all the expenses there was a net loss of £1,084. No offer could be made to the creditors. A resolution was passed confirming the voluntary liquidation of the company with Mr. Inkson as liquidator, together with a committee consisting of the chairman, Mr. Latham, and a representative of the Mullard Wireless Service Co., Ltd. The following are creditors:—

	£		£
Ward & Goldstone, Ltd.	881	British Thomson-Houston Co., Ltd.	32
Palmer Haines, Inkson and Co.	157	Milton Accumulator Co., Ltd.	30
Mullard Wireless Service Co., Ltd.	119	E.A. Mfg. Co., Ltd. ...	25
Edison Swan Electric Co., Ltd.	52	Charing Cross Electric Supply Co., Ltd. ...	21
Odhams Press, Ltd. ...	37	Dunk, A.	20
Trader Publishing Co., Ltd.	26		

SUTTON & BRIDGMAN, LTD., wholesale electrical dealers, 87, Redcliff Street, Bristol.—A meeting of creditors was held recently at the offices of Mr. H. A. Snell, 7, Unity Street, College Green, Bristol. The statement of affairs presented showed ranking liabilities of £2,170, all due to unsecured creditors, and net assets of £3,276, leaving a surplus, so far as the creditors were concerned, of £1,106. The issued capital of the company was £5,250; therefore, as regarded the shareholders, there was a deficiency of £4,144. Mr. Snell reported that he had been appointed to act as liquidator in the voluntary liquidation of the company. The stock, fixtures, and fittings had been practically realised, and would produce the amount shown in the statement of affairs. Subject to the collection of the book debts, the claims of the creditors would be paid in full. A resolution was passed confirming the voluntary liquidation of the company with Mr. Snell as liquidator.

NEW ROTO SIGN CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. Eves, 84, Chancery Lane, W.C. A meeting of creditors is called for June 12th, at the liquidator's offices. (This notice is purely formal, as all creditors have been or will be paid in full.)

3s WIRELESS TELEPHONE CO., LTD.—A meeting of members is called for July 6th at the offices of Messrs. G. Gradon and Co., 43, Gower Street, W.C., to hear an account of the winding up from the liquidator, Mr. A. M. Banks.

Our Wireless Export Trade.

The *Wireless Trader* gives particulars of the exports of radio apparatus from this country during March. The total value is given as £120,678, including valves valued at £19,230. France was the principal customer, its share amounting to £14,218 (valves £236), with Australia second, £12,156 (valves £7,339), and the Netherlands third, £11,289 (valves £263). Other large importers of these goods were: Bulgaria, £8,422 (valves £1,367), Rumania, £6,888 (valves £1,229); India and Burma, £6,062 (valves £1,335); Brazil, £4,247 (valves £136); Spain, £4,101 (valves £97); and Hungary £3,985 (valves £175).

Registered Electrical Contractors.

The following applications for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its meeting on May 31st:—

Burlingham, H., & Co., Ltd., Evesham.
Longstaff, T. M., Saltburn-by-Sea.
Williams, R. H., Newport, Mon.
Dickinson, T., Grimsby.
Johnston, J., Belfast.
Southern, A., & Co., Ltd., Bradford.
Crowther, N., Leeds.
Miller, J. E., Junr., South Shields.
Birkhead, H., Halifax.
Longton, A. T., Tonbridge.
Freeman, C. A., & Ball, A. H., Birmingham.
Jerram & Co., Ltd., Derby.
Star Electrical Co., Edgware Road, W.2.
Brown & Williams, Plymouth.
Axworthy, W. H., & Co., Plymouth.
Wise, F., Plymouth.
Ashfold, F. T., & Co., Plymouth.
Hodge, W., Plymouth.
Lord & Shand, Ltd., Plymouth.
Clayton & Rogers, Plymouth.
Simms, William, & Co. (Felixstowe), Ltd., Felixstowe.
Brewer & Phillips, Plymouth.
Gilbert & Stamper, Tonbridge.
Uneedus Electrical Co., Sutton, Surrey.
Cockburn, C. E., Regent Street, W.1.
Tarratt Bros., Leicester.
Morris, C. W., Plymouth.
Strand Electric & Engineering Co., Ltd., Floral Street, W.C.2.
Irvine, T. J., Falkirk.
Pawson & Manners, Bishophill, York.

At the same meeting three applications were declined and one was withdrawn.

Wages in the Electrical Contracting Industry.

The National Federated Electrical Association has issued a notice announcing a cost-of-living reduction in wages in the electrical contracting industry which will come into effect on the second pay-day in June. The new rates per hour are as follows:—Grade A, 1s. 0¼d. (¼d. decrease); Grade B, 1s. 7¼d. (¼d. decrease); Grade C, 1s. 6d. (¼d. decrease); and Grade D, 1s. 4¼d. (¼d. decrease). These rates will remain in force up to and including the period covered by the first pay-day in October.

Proposed American Cable-Radio Merger.

It was reported from New York this week that the International Telephone and Telegraph Co. was in negotiation for the acquisition of the communication business of the Radio Corporation of America (that is its interests apart from manufacturing and broadcasting). Should the negotiations be successful, the Telephone and Telegraph Co. would control practically the whole of means of communication in the Western Hemisphere. The president of the Radio Corporation has emphatically denied that there have been any negotiations with the stated end in view, and points out that the United States law would require alteration before sanction could be given to a combination of radio and telegraph companies.

Dissolution of Partnership.

LUND BROS. & CO. & ELECTRIC SIGN EQUIPMENT CO., electrical and mechanical engineers, 22, Bennett Street, and Paris Gardens, Blackfriars, S.E.—Mr. R. J. Triggs and Mr. C. A. N. Roberts have dissolved partnership. Mr. Roberts will attend to debts.

American Washing Machine Sales.

The total number of electric washing machines sold in the United States during 1927 was 775,661, as compared with 843,685 in 1926. During the first quarter of the current year the sales numbered 193,282, as against 190,925 in the first quarter of 1927.

Deed of Arrangement.

A. CHARLESWORTH PEEBLES & R. SHAW, trading as Charlesworth Peebles & Co.—The trustee, Mr. S. H. Gillett, 24, Basinghall Street, E.C.2, states that it will not be possible finally to wind up the estate until he has received from Mr. Peebles and distributed to the creditors the amount which is to become payable to Mr. Peebles by the Calgary Corporation for services rendered. The money is expected to become available later in the year, and it is hoped that it will enable the creditors' claims to be discharged in full. A first dividend of 4s. 6d. in the £ was declared in December last.

Book Notices.

"Distribution of Electricity" is the title of a monthly periodical (price 2d., post free) issued by Messrs. W. T. Henley's Telegraph Works Co., Ltd., of which the first number, for June, has reached us. An editorial points out that the time is fast approaching when generation and transmission will be in fewer hands, and most of its readers will be concerned only with distribution; to that end of the supply business we must look for economies—which can certainly be made. Whilst we cannot agree with the remark that the distribution system "is practically ignored by the technical Press," we welcome the new journal as an ally in the cause of electrical development.

"R. E. Crompton:—Reminiscences." Pp. xv+238; illustrated. London: Constable & Co., Ltd. Price 14s. net.

"Science Abstracts" (A. & B.). Vol. XXXI. Part 5. May 25th, 1928. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Die physikalischen Grundlagen der Elektrischen Festigkeitslehre," by N. Semenoff and A. Walther. Pp. vii+168; figs. 116. Berlin: J. Springer. Price, Rm.16.50.

"The Evolution of Industrial Organisation," by B. F. Shields. Pp. xii+296. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

"Faraday House Journal," Vol. XII, No. 6. Summer Term, 1928. Contains articles on "Time Constants and Transient Current Reversals in D.C. Circuits" and on "A Method of Checking the Strength of Interpoles in D.C. Machines," besides the customary notes and news items.

New Australian Meter Factory.

A new factory erected by the Electricity Meter Manufacturing Co. at Waterloo, New South Wales, at a cost of about £200,000, was recently opened by the Governor (Sir Dudley de Chair). Sir Dudley pointed out that only four years had elapsed since the company opened its first factory, which cost £20,000.

Australian Tariff Board's Electrical Inquiry.

In the course of its inquiry into the effects of import duties upon electricity supply undertakings, the Australian Tariff Board recently heard evidence in Hobart, Tasmania, from Mr. H. A. Curtis, chief engineer and general manager of the State hydro-electric works. Mr. Curtis maintained that the existing duty had failed to build up the industry or to give employment to a large number of people. The limited Australian demand for electrical equipment precluded the possibility of a highly-organised industry in continuous operation. On the other hand the duty seriously increased the cost of power to the consumer. His Department had paid £10,600 duty on seven 8,000-h.p. machines, and on seven alternators £9,100 duty had been paid. Among other instances which Mr. Curtis cited was the payment of £15,000 on high-voltage line transformers for rural development. He urged that the duty was a handicap in the supply of power to rural areas and in the development of the State generally.

For Sale.

Great Yarmouth Corporation Electricity Department has for disposal one 1,000-kW and one 500-kW frequency changers. Darwen Corporation Electricity Department has for disposal one 300-kW steam dynamo with condenser, valves, and pipes. (See our advertisement pages to-day.)

Unemployment in Germany.

The Times reports that during the first fortnight of May there was a decrease of 106,600 in the number of German unemployed, reducing the total to 785,100. The number of persons in receipt of insurance relief fell from 729,300 to 642,200, and the number in receipt of extended benefits from 162,400 to 142,900.

New Plant for Yallourn, Vic.

The Victorian Electricity Commission has ordered new plant for the briquetting factory at Yallourn, which will quadruple the present output and greatly reduce the cost of briquettes. The undertaking will cost in all £725,000. The extensions are expected to be fully in operation by 1930. Tenders have now been let for plant costing £264,000. The total cost exceeds the estimate by £10,000, chiefly due to preference being given to Australian manufacturers in the provision of certain parts. For the supply of briquette presses, driers, and cooling plant, the tender from the German firm Zeitser Eisenengiesserei for £79,398 has been accepted. For the supply and erection of four boilers the tender from John Thompson, Limited, Wolverhampton, for £185,301, has been accepted. The total value of new plant required will be £620,854, of which £364,233 will be expended in Australia and £119,800 elsewhere in the British Empire. The remainder will be spent on the briquetting plant, which is obtainable only in Germany.—*The Times.*

A Large Electrical Installation.

In the electrical work in the £100,000 war memorial wing of Blackburn Royal Infirmary, undertaken by Mr. T. Blackshaw, Higher Cockcroft, over 20,000 yd. of cable, 20,000 ft. of tubing, 600 lamps, and other electrical fittings have been installed.

Wages in the Engineering Industry.

At a recent meeting of representatives of the engineering trade unions, Mr. J. T. Brownlie, who was in the chair, said that the meeting had been called to decide whether the unions should again go forward together with an application for a national increase in wages or whether they should support local applications as they were put forward. After a discussion it was decided to apply for an advance of 8s. per week with a corresponding increase in piece-work prices. A request for a joint conference is being sent to the Engineering and Allied Employers' Federation.

Private Arrangements.

COLIN ANKERS, 41, Palmerston Street, Bollington, near Macclesfield, wireless dealer, &c.—A meeting of creditors was held recently, when a statement of affairs was submitted showing liabilities of £528 and net assets of £400, leaving a deficiency of £128. Owing to pressing creditors, a deed of assignment had already been executed to Mr. F. Hermann, C.A., of 2a, King Edward Street, Macclesfield. It was stated that cash claims would be withdrawn. A resolution was passed confirming the deed, and a committee was appointed consisting of the representatives of the bank, Messrs. Poppleton, Appleby & Turner, and Messrs. Harry L. Price & Co.

Trade Announcements.

Messrs. UNDERWOOD (MANCHESTER), LTD., have removed to larger and modernly equipped premises at 1, Dickinson Street, Manchester, where they will display several new ranges of electrical goods.

Messrs. Heap & Digby, Ltd., of 34, Victoria Street, S.W.1, have changed their name to HEAP & RYLEY, LTD.

The DUBILIER CONDENSER CORPORATION has removed to 10, East 43rd Street, New York.

Messrs. DIGBY, electrical and radio engineers, have opened premises at 152, Montreal Road, Tilbury.

Mr. JOHN ARMSTRONG, of Messrs. John Armstrong & Co. (Manchester), Ltd., informs us that his company is giving up business and that all creditors will be paid in full. The voluntary winding up of the business will be formal to comply with the requirements of the Companies Acts. The goodwill has been retained by Mr. Armstrong and not sold to any other firm.

Unemployment.

The Ministry of Labour returns record a decrease of 17,390 in the number of unemployed during the week ended May 21st. At the latter date the total was 1,101,000, as compared with 1,118,390 on May 14th and 978,176 on May 23rd, 1927.

Lithuanian Electrical Trade.

A report upon commercial and economic conditions in Lithuania, dated March, 1928, has been prepared for the Department of Overseas Trade by Mr. L. A. Parish, British Consul at Kovno (Stationery Office, 9d. net). In this Mr. Parish says that the market for electrical goods and apparatus is very largely in German hands, two leading manufacturers having branch houses in Kovno. Without similar organisation there are few openings for British goods, except perhaps in contract work. The wireless trade is in process of development, imports of sets and parts amounting to about £12,000 during last season. Crystal and single-valve sets are in chief demand, supplied mainly by Germany, with competition from Sweden and the United States. British makers might find the best opening in the small market for the highest class components and the more elaborate sets, but retail prices are, if anything, lower than in England. An appendix shows that during 1927 about 200 metric tons of electrical goods and scientific instruments, valued at 3,965,100 lits, were imported into Lithuania. In the preceding year the amount was 175 tons, and the value 2,691,400 lits (£=49 lits). Mr. Mc.E. Vibert, Vice-Consul at Memel, says that the city is in negotiation for a loan of a million dollars for electric power development.

Prices of Raw Materials.

Reporting on June 2nd, Messrs. James Forster & Co. stated that the firmness in lead at the end of the previous week was again in evidence when the market opened after the holidays, all positions advancing. Following on the firm tone here, the price in New York was raised. The recent firmness in lead is entirely due to an improved demand from the Continent, and can in no way be ascribed to any improvement in conditions here, where consumption remains very moderate. An increased demand from Germany or Russia has the effect of diverting supplies from this market, so that it is quite likely that lead will not be too plentiful this month. The future depends on whether this Continental demand is maintained, but it seems probable that higher prices will be seen again in the near future.

Messrs. F. Smith & Co. report, June 5th:—No change in the prices of electrolytic copper bars, sheets, wire rods, and h.c. wire.

Messrs. James & Shakespeare report, June 5th:—Copper bars (best selected), sheet and rod, £94, £2 inc.; English pig lead, £23, 10s. inc.

Messrs. Edward Till & Co. report, June 5th:—India-rubber, Para fine, 10¾d., ¼d. inc.

Messrs. C. Clifford & Son report, June 5th:—Babbitts metal and anti-friction metal, Grade I, £205, £5 dec.; Grade II, £141, £4 dec.; Grade III, £75, £2 dec.; phosphor bronze wire, 1s. 3¾d., ¼d. inc.

Lighting and Power Notes.

Argentina.—ELECTRICAL DEVELOPMENT.—The report of the Compañia Italo-Argentina de Electricidad for the year ended December 31st last shows a net balance of $4,929,161, to which was added a balance of $160,862 carried forward from 1926, making a total of $5,090,023. After payment of dividends and other charges, there was a surplus carried forward of $191,523. The extension of the Pedro Mendoza power station was practically completed during the year, and the station now has a capacity of 100,000 kW. The first group of 25,000-30,000-kVA sets was put into commission in May, and the second group of the same capacity in December. The cable network was increased by 221,000 metres, making the total length 2,197,971 metres. Thirty new static transformer substations were put into service, bringing the total up to 140, with an installed capacity of 30,305 kVA. The installed load for all services totalled, at the end of the year, 119,243 kW, an increase of 5,771 kW. The electrical energy generated was 114,794,457 kWh, and the total sold amounted to 103,590,503 kWh. The Executive Power of the Nation, in July last, granted the company the right to occupy 90,000 sq. m. on the bank of the River Plate (New Port of Buenos Aires), and it is proposed to erect a new power station with an ultimate capacity of from 300,000 to 500,000 kW. A supply of electricity to the city of Avellaneda was commenced in June last.

Barnstaple.—NEW PLANT.—The Town Council has received consent to the installation of a 100-kW Diesel engine at the generating station.

LOAN.—A loan of £1,000 for mains, services and meters has been applied for.

Barrow.—YEAR'S WORKING.—The Corporation electricity undertaking, for the year ended March 31st last, showed a gross profit of £44,942, as compared with £29,934 in the preceding year, and after deducting loan charges to the value of £30,906, there was a surplus for the year of £14,306, as against a deficit of £1,484 in 1926-27.

Bradford.—NEW PLANT.—Work on extensions to the Corporation power station was to commence on June 5th. The extensions include the installation of a new 30,000-kW set and high-pressure boiler plant of 1,100 lb. The scheme, which will involve an expenditure of over £300,000, is expected to be completed in about twelve months. The whole scheme has been prepared by Mr. T. Roles, the city electrical engineer.

Brighton.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £5,820 for alterations to the e.h.p. switchgear at Southwick power station.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Calgary Power Company's project on the Bow River, just below the Ghost River junction, will be the largest water power development in Alberta. The project involves the development of from 20,000 to 30,000 h.p. at a cost of approximately $2,500,000; the pondage would create a reserve of 3,000,000 kWh. With the highest part of the concrete dam rising 95 ft. above the present river bed, the dam will give a head of 90 ft.

Investments of private capital in hydro-electric schemes now in progress in Manitoba will amount approximately to $100,000,000. Within 75 miles of Winnipeg, the Manitoba Power Company is preparing to develop Seven Sister Falls on the Winnipeg River. This enterprise will involve an expenditure of $24,000,000 during the three years necessary to complete the work, and add approximately 150,000 h.p. to the company's output. The Hudson Bay Mining and Smelting Company contemplates a large development at White Mud Falls, 600 miles north of Winnipeg. The Sherritt Gordon Mining Company has in view a similar electrical enterprise on the Nelson River.

Chelmsford.—ELECTRICITY CHARGES.—The Corporation has instructed the Town Clerk to press the Electric Supply Corporation, Ltd., for a reply to his letter, and if no further reduction in the charges for electricity is made by the company, he is authorised to apply to the Ministry of Transport for a further reduction.

Continental.—SWEDEN.—The total utilisation of Sweden's "white coal" through Swedish power stations now amounts to about 1,500,000 h.p., and the total production of electrical energy, generated by water-power in 1927 amounted to 4.35 billion kWh, according to announcements made at the recent annual meeting in Stockholm of the Swedish Water-power Association. Amongst recently completed power plants is that of the Hammarsforsens Kraftaktiebolag. This plant, the capacity of which now amounts to 27,000 h.p., has just been completed, together with power transmission lines 160 km. in length. The ultimate capacity will amount to about 67,000 h.p. Nearly 50 per cent. of the farming area in Sweden is electrified. Only a small part of the total water-power resources has, so far, been exploited; according to a recent estimate by the Government Waterfalls Board, the resources total 6½ million h.p. during nine months of the year and a further ten million h.p. during six months of the year. A national system of h.p. main lines covering the entire country is gradually being constructed, whereby the power from the great falls in the north will be transmitted and distributed to the central and southern

parts. It is being planned to regulate the level and water supply of Swedish lakes, situated at various altitudes, whereby an additional power supply of more than 11 million h.p. will be made available all the year round. The Waterfalls Board in its recent annual report showed a net surplus of over 14,000,000 kronor, 13.59 millions of which was derived from the power plants.

CZECHO-SLOVAKIA.—The Berg und Huttenwerke Gesellschaft is increasing the plant at its power station at the Ignaz collieries near Marienberg by the addition of a 30,000-h.p. steam turbo-generator, which will bring the capacity of the plant up to 60,000 h.p. It is also intended to link up the station with that of the Witkowitz Iron Works and that of the Northern Railway at the Franz Collieries in order to provide a supply of electricity throughout the Mahrisch-Ostrau district.

RUSSIA.—A scheme is under consideration for the establishment of eight hydro-electric power stations to utilise the water power of the River Msta. It is estimated that 206,000 h.p. is available.

Dover.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to a loan of £2,000 for mains.

Guildford.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £7,000 for plant (sub-station equipment) and kiosks, and £27,000 for mains.

ELECTRICITY SUPPLY.—At a recent meeting of the Corporation Electricity Committee, the Town Clerk submitted a letter from the Shere Parish Council, inquiring whether it was proposed to bring the electricity main to Peaslake, also whether it had been decided to start laying the main this year. The borough electrical engineer reported that the capital outlay involved in supplying electricity to Peaslake would be approximately £4,000. It was decided to inform the Council that the main will be laid to Albury and Shere by September, and that the Corporation will be prepared to extend the main if residents in the neighbourhood of Peaslake guarantee a return of 20 per cent. on the outlay.

Harwich.—LOANS.—The Corporation Electricity Committee is seeking sanction to the following loans:—Wiring, £1,000; meters, £1,000; services, £1,000.

Hornsey.—CABLE EXTENSIONS.—The Corporation Electricity Committee has decided to extend cables at a cost of £2,350.

Liverpool.—NEW GENERATING STATION.—The Corporation Finance Committee, on May 25th, approved on financial grounds the project for a new power station at the Clarence Dock, as part of the Government scheme of development. It was explained that the interest and sinking fund charges on the capital of £1,600,000, to be expended on the first instalment of the station, would be borne by the Government, and that the Corporation would be entitled to a bulk supply of electricity at a cost not exceeding the figure at which it could have been generated by an extension at Lister Drive.

London.—HAMMERSMITH.—The Borough Council is applying for sanction to the allocation of a further sum of £2,000 in connection with the hire-purchase, hire and purchase of electric wiring installations.

Luton.—ELECTRICITY EXTENSIONS.—The Electricity Commissioners have informed the Town Council that they cannot sanction the erection and equipment of the proposed new generating station at Chaul End, but would give favourable consideration to an application for consent to the extension of the existing station by the installation of a 12,500-kW set. The Council has decided to carry out this scheme.

Maidstone.—LOAN.—The Town Council has applied for sanction to a loan of £4,320 for laying a h.p. main to supply electricity to Leeds Castle.

Manchester.—YEAR'S WORKING.—The *Manchester Guardian* reports that the accounts of the Corporation Electricity Department show a successful year's working. The income from sales of electricity, &c., declined slightly to £1,604,167, as against £1,643,137 in 1926-27, but, on the other hand, working expenditure dropped from £984,106 to £864,417. Consequently, there was a balance of £739,750, as against £659,031; or, with debt and tax charges deducted, a net surplus of £110,942, as against £40,659. During the past year there has been an addition of nearly 90 miles to the mains laid, making a total length of more than 900 miles. The cooker-hiring scheme has made good progress. The number of cookers installed was 4,314, an increase of 1,285 for the year.

Morecambe.—LOAN SANCTIONED.—The Corporation Electricity Department has received sanction to borrow £1,150 for works in connection with the supply of electricity to the London, Midland & Scottish Railway Co. at Heysham Harbour.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

BETTWS-Y-COED (CARNARVON).—Lighting: From 6d. to 4d. per kWh. Power: From 3d. to 2d. per kWh.

LEYTON.—Ordinary lighting: From 5d. to 4d. per kWh. Prepayment meters: From 6d. to 5d. per kWh.

Salford.—LOAN.—The Corporation Electricity Committee is seeking sanction to a loan of £15,000 for sub-stations on consumers' premises, and transformer pits and pillars.

Seaham Harbour.—LOANS SANCTIONED.—The Urban District Council Electricity Committee has obtained sanction to the borrowing of £1,540 for mains, £500 for meters, and £200 for domestic apparatus to be let out on hire.

Shrewsbury.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £8,150 for the installation of a second Diesel-engine set at the electricity works.

South Shields.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £10,000 for services and £10,000 for consumers' wiring installations with pre-payment meters for hire.

Special Orders.—Application has been made to the Electricity Commissioners by the Derbyshire and Nottinghamshire Electric Power Co., for a Special Order authorising it to supply electricity in the rural district of Misterton, and certain parishes in the rural district of Worksop.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Mr. W. T. Warren to supply electricity in the urban district of Brightlingsea and the Urban District Council of New Mills to supply electricity within its area.

Wimbledon.—LOANS.—The Corporation Electricity Committee is applying for sanction to a loan of £15,000 for the purchase of electrical domestic apparatus to be let out on hire. Sanction has been received to the borrowing of £16,905, for the installation of an additional 50,000-lb. boiler at the generating station.

York.—NEW PLANT.—The city electrical engineer has reported to the Electricity Committee that the steam tests on the second 6,000-kW turbo-alternator have proved satisfactory. The Lord Mayor was to start the new turbine on June 6th.

"ALL-ELECTRIC" HOUSES.—The Corporation Housing Committee has decided that the houses to be erected on land fronting to Hull Road, Tang Hall Lane, and Osbaldwick Lane shall be equipped as "all-electric" houses.

Tramway and Railway Notes.

Australia.—SYDNEY (N.S.W.).—The appointment of a Ministry of Transport is recommended in a report prepared by the Traffic Advisory Committee. According to the *Sydney Morning Herald*, the Committee also advocates the creation of a State transport committee or commission, and expresses the opinion that there should be a greater measure of co-ordination between tramway and motor-'bus services to prevent wasteful competition and overlapping. With a view to economy in road space, the Committee suggests that two-decked tramcars and 'buses should be given a trial.

According to the *Industrial Australian and Mining Standard*, the recent strike at Walsh Island has completely disorganised the plans of the New South Wales Railways Commissioners regarding the extension of the electrification of the metropolitan railways. The dispute in question caused a serious dislocation of the programme for the construction of railway carriages. It was expected that a full electric service would be introduced on the Milson's Point-Hornsby line at the beginning of May. While electric trains are being added to that service as they become available, it will probably not be until July that the last steam train is withdrawn from the line. The trouble at Walsh Island will also affect the electrification of the main suburban line. It was intended to place the first electric train in the Sydney to Homebush service early in May, but it is not expected that an electric train service along the main line will be in operation until about August.

Continental.—FRANCE.—With a view to reducing traffic congestion on the boulevards during the summer, the Paris City Traffic Board has decided to abandon a number of tramway routes and divert others. No more tramway track is to be constructed in the city or its environments, and the present tramway system is gradually being replaced by motor-omnibus services.

Irish Free State.—DUBLIN AND LUCAN ELECTRIC TRAMWAY.—The new Dublin and Lucan tramway of the Dublin United Tramways Co. was formally inaugurated at Whitsuntide. The line runs along the Liffey to the centre of the city. The districts along the route are rapidly developing in residential character, and it is anticipated that the extension will prove one of the most remunerative sections of the company's lines.

Japan.—TOKIO.—A first section, about 1¼ mile in length, of the new electric underground railway in Tokio has recently been completed and opened for traffic. The line is operated at 600 V, d.c., each locomotive being equipped with two 120-h.p. motors.

Southern Railway.—DERAILMENT OF COACHES.—The derailment of two coaches on the Southern Railway's electric service between Richmond and Waterloo early in the morning of May 31st caused considerable delay to passengers travelling to the City.

Sunderland.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking for the year ended March 31st last record a total revenue of £128,899. Working expenses amounted to £101,360, leaving a gross surplus of £27,538. On the East End 'bus route, commenced in February, there was a surplus of £62. After payment of capital charges, there was a net surplus of £8,801, of which £1,500 was transferred to the borough fund and the remainder placed to reserve and renewals fund.

Telegraph and Telephone Notes.

Afghanistan. — RADIO-TELEGRAPHY. — The Government of Afghanistan is reported to have lately placed a contract with a French firm for the material for three short-wave radio-telegraph stations. A number of French experts are to be sent out to Afghanistan to establish the system.

Canada.—SHIP-SHORE TELEGRAPHY.—The Canadian House of Commons has voted a sum of $250,000 (£50,000) for ship-to-shore radio-telegraph stations.

China.—RADIO-TELEGRAPHY IN MANCHURIA.—The Mukden authorities have done a great deal toward improving old wireless stations as well as installing new ones. There are now 11 stations in such places as Harbin, Mukden, Changchun, Yingkow, Tsitsihar, Suifen, and Yenki. Recently a short-wave wireless station was installed at Mukden at a cost of $600,000, which, according to the *Chinese Economic Bulletin*, is capable of sending messages to Europe and America.

When the wireless station at Harbin commenced to communicate with Europe, the Japanese authorities in Manchuria protested to the local provincial government on the ground that it was an evasion of treaty obligations.

TIENTSIN TELEPHONE SERVICE.—The Tientsin Telephone Company has reported to the Ministry of Communications that during 1927 some 2,068 telephones were installed, bringing the total up to 17,643 now operating in Tientsin. Most of the lines recently laid are underground, and with the introduction of automatic telephones, service will be brought to a very high standard. It takes only three seconds for an operator to make a connection. According to the *Chinese Economic Bulletin*, the Company's profit for 1927 was $186,478.

Germany.—RADIO-TELEPHONY.—The German Telegraph and Telephone Department, in co-operation with the Dutch Telegraph and Telephone Department, recently succeeded in establishing radio-telephone communication between the Dutch section of the International Press Exhibition and the Dutch East Indies. The Dutch Minister of Labour, Dr. J. R. Sloetemaker, inaugurated the demonstration, and in spite of some interruption by Morse signals, reception was particularly clear. The demonstration will be repeated each Tuesday afternoon during the period of the exhibition. In another demonstration the German telephone authorities established communication between the exhibition conference room and Buenos Aires, South America. Greetings and complimentary messages were exchanged between various Cologne notabilities and members of the German colony and the Press in the Argentine with perfect clearness.—*Reuter* (Cologne).

Haiti.—COMMUNICATION SERVICES.—There are now 1,490 miles of telegraph and 4,608 miles of telephone wires in operation in the Republic of Haiti, as compared with only 950 and 2,860 miles, respectively, in 1924.

International Telephony.—ANGLO-SPANISH SERVICE.—The new direct Anglo-Spanish telephone service permits of direct communication between Great Britain and all telephone offices in Spain and Gibraltar and Ceuta. Portugal will also be able to communicate with Great Britain by the same line.—*Reuters* (Madrid).

Marine Radio Equipment.—CANADIAN SHIPS' SETS.—The five newly-built cargo ships of the Canadian Pacific fleet are all equipped with Marconi apparatus for wireless communication and direction finding. The main installations are 1½-kilowatt quenched-spark transmitters and two-valve receivers. The transmitters are sharply tuned to 600-, 706-, and 800-metre wavelengths, covering all the requirements of ship-to-ship and ship-to-shore communication over distances of eight hundred miles. The receivers are adjustable to cover all commercial messages and news broadcast on wavelengths much higher than those normally used by ships. In addition, the equipment is completed by auto-alarms for calling attention to a distress call in the absence of the operator.

The Telephone Service.—AUTOMATIC SWITCHING.—The new satellite automatic telephone exchange which has just been completed at Armley, Leeds, brings the number of automatic exchanges in the country to exactly 100. The new exchange will serve a large area on the western side of the city. Of the one million and a half telephones in the country, approximately 150,000 are now working on the automatic principle.

United States.—RADIO BEACONS.—Three radio beacons on Long Island Sound were put into operation last month by the Lighthouse Service of the U.S. Department of Commerce to guide ships having the necessary equipment in foggy weather. The beacons are at Execution Rock lighthouse, east of Hell Gate bridge at the western entrance to the Sound; at Stratford Shoals light, off Bridgeport, Conn., and at Little Gull Island light, southwest of New London, Conn. The automatic transmitting sets broadcast dots and dashes which navigators utilise to locate their exact positions; each beacon has its identifying series of code characters which ships' radio operators intercept on direction finders.—*Reuter's Trade Service* (New York).

RADIO COMMUNICATION.—With further reference to the recent note on the above subject (page 911, May 25th issue), the *Financial News* announces that the American Telephone and Telegraph Co. and the International Telephone and Telegraph Co. are planning a radio-telephone link, to open in the spring or summer of 1929, between New York and Buenos Aires.

The Federal Radio Commission has allocated twenty short wave-lengths to the American Publishers Committee for the special use of the Press when transmitting news transoceanically. The Commission granted the Mackay Co. fifteen wavelengths, instead of the nineteen requested, and also granted the Radio Corporation fifteen channels, instead of fifty-five as asked for.

The Federal Trade Commission has issued a complaint against the Radio Corporation of America, charging it with creating a monopoly in radio valve grades and with unfair competition in entering into certain licence agreements with other radio manufacturers.

Radio Notes.

Austria.—NEW STATION.—The equipment for the 500-watt station at Linz has been installed; *World Radio* expects the plant to be officially opened at the end of this month for the regular transmission of the Vienna programme.

B.B.C. Studios.—LONDON PREMISES EXTENDED.—The B.B.C. has recently completed the latest addition to the London studios at Savoy Hill, bringing the number now in use up to nine. It has been built on the site of a Turkish bath which was a popular resort in pre-war days, and the complete remodelling of the basement at Savoy Hill, where it is situated, was a rather hazardous task, as it involved incorporating in the construction scheme some important columns which carry the weight of the whole building. No. 9 studio is 22 ft. long by 19 ft. 6 in. wide; its solid brick walls are covered with four layers of hessian cloth, the layers being separated one from another by wood battens half-an-inch thick. In front of this is a framework carrying a special acoustic boarding, half of which is covered with felt half-an-inch thick, prepared to carry the decorative wall panels with which the remainder of the boarding is also treated. The concrete ceiling is partially covered with felt in such a way that its presence is unnoticed by the eye, it being broken into panels which form a pleasing effect in the general decorative scheme. Ducts emit fresh air and extract the vitiated air by artificial means. The decoration of the studio is a complete innovation: the room is painted in red, black, and gold, and its walls bear a pictorial scene of Chinese character in which the phœnix forms the theme. The studio has proved to be best suited for instrumental soloists and combinations up to an octet. It will not be used for speech and announcements will be made from the observation chamber outside the studio.

Canada.—ROYAL COMMISSION.—A Royal Commission is to inquire into broadcasting throughout Canada, and advise as to its future administration and control. The Government is contemplating control, based on the British system, says *The Times*, with public ownership of all broadcasting stations.

New Zealand.—NEW TRANSMITTER.—The Manawatu Radio Club has opened a station in Palmerston, with the call signal of 2ZF and a wavelength of 280 m., which has been heard all over New Zealand. The transmitter is claimed to be of a new design.

Union Radiophonie.—CONFERENCE.—A conference of the Council of the Union Internationale de Radiophonie, under the presidency of Admiral Carpendale, and a European Conference of Broadcasting Engineers have concluded their sittings at Lausanne. The Council ratified the admission of new members to the Union as follow:—Radio Stanica, Zagreb; British East African Broadcasting Company, Nairobi; Société Roumaine de Radiophonie, Bucarest. The Council recommended that the identity of broadcasting stations should be stated as clearly as possible. Some twenty European countries were represented at the Engineers' Conference, when discussions took place on the methods of eliminating interference with broadcasting by tramcars, lifts, and other electrical apparatus, and on the latest experiments in short-wave transmission. The technical conditions indispensable to the relaying of programmes over long distances by means of telephone lines and cables were also examined. The sittings concluded with the annual general assembly of the Union, when the members of the Council were re-elected and the latter body afterwards re-elected as its president Admiral C. D. Carpendale (Great Britain) and as its two vice-presidents Herr H. Giesecke (Germany) and M. R. Tabouis (France); M. M. Rambert (Switzerland) was re-elected Council delegate. A new Commission to deal with problems affecting international relays by wire and wireless was appointed under the presidency of M. S. Chamiec (Poland).

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Atherton.—June 28th. Urban District Council. Two 130-kVA transformers. (See this issue.)

Australia.—MELBOURNE.—July 17th. Postmaster-General's Department. Switchboard cable. (B.X. 4431.)*
Automatic telephone switchboards. (B.X. 4480.)*

Belfast.—June 18th. Electricity Department. Overhead transmission line between Stockman's Lane at Balmoral and Black's Lane at Dunmurry. (See this issue.)

Blantyre, Nyasaland.—Town Council. One 120-h.p. cold-starting crude-oil engine, direct coupled to a 120-kVA a.c. generator, with exciter, or, alternatively, one 120-h.p. suction gas engine, direct coupled to an a.c. generator; 500 tons best anthracite beans. (June 1st.)

Conisborough.—June 19th. West Riding Education Committee. Electric lighting installation at the New Middle School. Specifications from Education Department, County Hall, Wakefield.

Douglas.—July 2nd. Corporation. One 1,000-kW steam turbo-alternator, condensing plant, cooling tower and accessories, two 15,000-lb. boilers, with pipework and accessories. (June 1st.)

East Ham.—June 13th. Education Committee. Wiring for electric lighting Napier Road school. Specification (10s.) from the Electrical Engineer, Electricity Department, Nelson Street, East Ham.

Greenock.—July 2nd. Trustees of the Port and Harbours. Electrification of the Garvel pumping station, altering steam pumps to electric drive or, alternatively, two electrically-driven dock pumps, electrically-driven hydraulic pumps, &c. Specifications (42s.) from Mr. A. Leitch, consulting engineer, 65, Bath Street, Glasgow.

Grimsby. — June 14th. Electricity Department. One 10,000-kW turbo-alternator with condensing plant. (May 25th.)

Guiseley (near Leeds).—June 19th. West Riding Education Committee. Electric lighting installation at the new school. Specifications from Education Department, County Hall, Wakefield.

Hawarden.—June 22nd. Urban District Council. Overhead transmission lines. (See this issue.)

Irish Free State.—DUBLIN.—June 13th. Electricity Supply Board. Supply and laying of 10,000-V and 380-V underground cables in the County of Dublin. (May 25th.)

Leeds.—June 16th. Board of Guardians. Supply of stand-by battery for St. James's Hospital, Beckett Street. Mr. J. E. Storr, 14, Park Row, Leeds .

London.—CENTRAL ELECTRICITY BOARD.—June 29th. 132,000-V overhead transmission lines for the South-East England electricity scheme. (May 18th.)
LONDON COUNTY COUNCIL.—June 12th. Electric lift (15 cwt.) for the Weights and Measures Office. (June 1st.)
WANDSWORTH.—June 20th. Board of Guardians. Reorganisation of the engineering plant (laundry, central heating, electric lighting, and water softening) and electric wiring at the Swaffield Road Institution. (See this issue.)

Manchester.—June 18th. Electricity Committee. Electrically-operated wagon tipper for Barton station. (May 25th.)
June 12th. H. and l.p. pipework, supports, &c., for steam-heating services. Forms of tender (2ls.) from Mr. H. C. Lamb, chief electrical engineer, Town Hall, Manchester.

New Zealand.—WELLINGTON.—July 10th. Public Works Department. 50-kV switchgear and steelwork for Arapuni power scheme. (B.X. 4410.)*
July 17th. Two 12-ton trolley electric locomotives, four 4-ton ditto, seven 4-ton battery locomotives, with spares, two 150-kW motor-generator sets and switchgear, and overhead line equipment. (A. 6317.)*
June 26th. Posts and Telegraph Department. Telephone cords. (B.X. 4472.)*

South Africa.—CAPE TOWN.—June 13th. City Council Insulated copper wire. (B.X. 4437.)* Electric light poles, cross arms, insulators, street lighting fittings, &c. (B.X. 4441.)*
JOHANNESBURG.—July 26th. South African Railways and Harbours. Two 25-ton, six 10-ton, and two 2-ton electrically-driven overhead travelling cranes. (A.X. 6347.)*
July 12th. 120-kVA transformers and truck-type switchgear. (B.X. 4479.)*

Sunderland.—July 9th. Electricity Department. Cable, r.i. wire, consumers' meters, and incandescent lamps for 12 months. (See this issue.)

Tain.—July 4th. Corporation. Underground and overhead mains, street lighting, and meters. (June 1st.)

Taunton.—June 18th. Electricity Committee. Paper-insulated cables. (See this issue.)

Uruguay.—MONTEVIDEO.—July 13th. State Electricity Supply Works. Twelve 3-phase, 33,000-V transformers. (B.X. 4461.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Brentford.—Board of Guardians.
Installation of electricity at the hospital (£477).—Langston, Jones & Co.

Deal.—Town Council. Accepted:—
Installation of electrical illuminations for the pier (£200).—C. O. Clark.

Dewsbury.—Dewsbury and District General Infirmary Buildings Sub-Committee. Accepted:—
Electric lighting and power installations at the new general infirmary (approx. £3,000).—Ward & Co., Ltd.

Dundee.—Corporation. Accepted:—
Carbon filament and gasfilled electric lamps.—Edison Swan Electric Co., Ltd.

Henley-on-Thames.—Board of Guardians. Accepted:—
Installing electric light at the Institution (£442).—R. J. and H. Wilde. Fourteen tenders were received.

Hornsey.—Education Committee. Recommended:—
Installation of electric lighting at Coldfall School (£1,117).—Southey & Co.

Hounslow.—Electricity Committee. Accepted:—
Cables, with pilot and telephone conductors, for the eastern area extension (£24,985).—Enfield Cable Works, Ltd.
Switchgear for the generating and sub-stations (£9,095).—General Electric Co., Ltd.
Two 300-kVA transformers (£420).—Hackbridge Electric Construction Co., Ltd.

Hull.—Electricity Committee. Accepted:—
33-kV overhead transmission line:—

WATSHAM'S, LTD. (accepted)	£17,250
John Collins & Co. (Electrical Engineers), Ltd. ...	17,664
W. T. Glover & Co., Ltd.	17,791
Macintosh Cable Co., Ltd.	17,844
W. T. Henley's Telegraph Works Co., Ltd. ...	18,399
Callender's Cable & Construction Co., Ltd. ...	18,461
Pirelli-General Cable Works, Ltd.	19,349
Do. (Alternative)	19,385
British Insulated Cables, Ltd.	19,534
Power Lines Construction Co., Ltd.	20,017
Siemens Bros. & Co., Ltd.	20,270
Foundation Co., Ltd.	21,448

Leeds.—Electricity Committee. Recommended:—
Concrete rafts, intake tanks and ducts at the Kirkstall power station (£42,104).—H. Arnold & Sons, Ltd.
Automatic control apparatus for the boiler-house equipment (£7,000).—International Combustion, Ltd.

Leyton.—Electricity Committee.
Electric public clock for the Leyton Electricity Department showrooms.—Synchronome Co., Ltd.

London. — SOUTHWARK.—Electricity Committee. Recommended:—
Alterations to two generating sets (£550 per set) and alterations to condensers and pumps (£225).—Piggott Electrical Co., Ltd.
Spare armature for rotary convertors (£907).—General Electric Co., Ltd.
LONDON & NORTH-EASTERN RAILWAY CO.:—
Ten months' supply of electric train-lighting lamps.—Siemens Electric Lamps & Supplies, Ltd.

Manchester.—Electricity Committee. Accepted:—
Cable.—W. T. Glover & Co., Ltd., Callender's Cable and Construction Co., Ltd., Pirelli-General Cable Works, Ltd., and W. T. Henley's Telegraph Works Co., Ltd.
Weldless steel spigot and faucet tubes.—Stewarts and Lloyds, Ltd.

Circuit breakers.—J. G. Statter & Co.
Eight 250-kVA static transformers.—Bruce Peebles & Co., Ltd.
Switchgear.—Ferguson, Pailin, Ltd.
Electric motors.—Crompton-Parkinson, Ltd., and Electromotors, Ltd.
Motor starting switches.—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee. Accepted:—
Street point controller.—Forest City Electric Co., Ltd.
Copper and cadmium trolley wire.—Richard Johnson and Nephew, Ltd.
Special track work.—Edgar Allen & Co., Ltd., Hadfields, Ltd., Titan Trackwork Co., Ltd.

Watch Committee. Accepted:—
Electric lighting installation at Willert Street police station.—A. E. Sudlow & Co.

Water Committee. Accepted:—
Replating positive and negative plates in storage battery at Longdendale works.—Alton Battery Co.
Electric wiring.—Dale Head Hall, Thirlmere.—John Adams, Ltd.

Housing Committee. Accepted:—
Electric lighting installation for houses on various estates.—Clampnett & Co.

Lincoln.—
Installation of electric lighting at the Albion Hotel, High Street.—Mr. G. A. Howard.

Salford.—Tramways Committee. Accepted:—
10,000 electric traction lamps (£625).—B. Travers & Co., Ltd.
Commutator spares (£287).—Forest City Electric Co., Ltd.
Insulating tapes (£228).—Hamnett & Andrew.
Gear and pinion wheels (£874).—British Hele-Shaw Patent Clutch Co., Ltd.
Brake blocks (£1,020).—National Rail and Tramway Appliances Co., Ltd.
Trolley wheels (£443).—J. Holroyd & Co., Ltd.

Forthcoming Events.

British Electrical Refrigeration Campaign.—June 8th to June 25th.

Physical Society.—Friday, June 8th. Imperial College of Science, S. Kensington, S.W. 5 p.m. Ordinary meeting.

Society of Engineers (Incorp.).—Saturday, June 9th. 3 p.m. Visit to the New London Terminal Aerodrome, Croydon.

Incorporated Municipal Electrical Association.—June 11th to June 16th. Bath. Annual convention.

Electroplaters' and Depositors' Technical Society.—Wednesday, June 13th. Northampton Polytechnic, St. John Street, E.C. Annual general meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

SIMPLEX self-sustaining winch (believed Birmingham made).
VIO-RAY combined ultra-violet ray arc lamp and resistance heater (probably American).
METEOR arc lamps with self-contained resistances for the use of photographers (probably German).

Notes.

Sydney Bribery Charges.

At its sitting on May 31st the Royal Commission which is inquiring into the allegations of bribery in connection with a large power-plant contract for the Sydney City Council heard evidence from Alderman Green, who had been stated to have received £7,500 for distribution among his colleagues on the Council from Mr. S. Y. Maling, deputy general manager of the Council's Electricity Department. The witness strongly denied that he had had any money from Maling or that Maling had approached him with any improper suggestions concerning money in connection with the tender put in by Babcock and Wilcox, Ltd.

On the following day Mr. W. Holdsworth, formerly an alderman of the city, gave evidence, in which he denied that Mr. Arnot (Babcock & Wilcox, Ltd.) had ever paid him £250 as commission. He said that "graft" had been rampant in Sydney's municipal affairs for 30 years, and was worse under the Civic Reform rule than under the Labour régime.

Educational.

BATTERSEA POLYTECHNIC.—Electrical Engineering Department.—The 1928-29 session commences on September 18th. Full particulars of the day and evening courses in Mechanical, Civil and Electrical Engineering, can be obtained from the Principal, Mr. G. F. O'Riordan. (See our advertisement pages to-day.)

Traffic Signals at Edinburgh.

A report on the working of the new street electric traffic control system recently introduced by Edinburgh Corporation has been prepared by the chief constable, and a sub-committee has recommended that the system be extended throughout the city. The estimated cost of installing three-colour electric signals at sixteen crossings is £3,360.

The "Stethophone."

An ingenious development of telephony, which has been tried at the International Labour Conference at Geneva, Switzerland, promises to save much time and avoid the tedious repetition that has hitherto been inseparable from the customary method of translating each speech into as many languages as necessary and reading it in full after the original speaker has finished speaking. Messrs. S. G. Brown, Ltd., co-operated with the International Labour Office in providing equipment that functions in the following manner:—Around the rostrum, within sight and earshot of the speaker, sit a number of interpreters, each speaking a language different from the orator's and his neighbours; each interpreter is provided with a light microphone, encased in rubber sponge, so as to be free from unnecessary vibration, and so "damped" that it is sensitive only to the subdued voice of its user, and not to that of the orator proper or the noises of the Conference Hall. Coupled to the microphones are amplifiers and distributing circuits leading to the various tables, where electrically-operated diaphragms feed the headpieces with a reproduction of the interpreters' voices.

The task of the interpreter is to provide a running translation of the speech being made in the language in which he specialises, and it is claimed that immediate interpretation (the translation is never more than a sentence behind the speech being translated) appears to be far less fatiguing and less prone to error than an interpretation from memory or shorthand notes. The listener at a table in the Conference Hall places over his ears stethoscopic earpieces, which weigh only two and a half ounces, turns a switch until the indicator points to the language in which the listener is interested, and then, by means of a knob, controls the strength of the speech. All other manipulations are in the hands of the interpreters, and are confined to lifting the microphone from, or to, a hook which is a master switch. The headpieces will adapt themselves to heads of all shapes and sizes without putting undue pressure on the ears; they are well ventilated and will be sterilised by a routine process. One can wear them in comfort and sit quite close to an orator and yet receive, without noticeable interruption, not the voice of the orator himself, but the translation of a chosen interpreter.

At the recent Conference arrangements were made to test a combination of this system with one for making permanent records of the speeches delivered, which can be transported easily to the International Labour Office for transcription by the normal staff, and can be kept as a check in case of dispute. It is also probable that at a later meeting a short-wave telephone relay between the Conference Hall and the permanent staff at the "Palace of Labour" may be developed to save even the time which would be lost in transporting permanent speech records over a distance of about 2½ miles.

British Magnetos and Empire Air Survey.

We learn with interest that the Short-Rolls-Royce all-metal flying boat used by Sir Alan Cobham during his remarkable pioneer Empire air-route survey flight of 23,000 miles, embracing the commercial centres of Africa, is equipped with magnetos made by the British Thomson-Houston Co., Ltd., which was responsible for the magnetos used by the "Ambassador of Empire" on his earlier epoch-making flights.

Association of Supervising Electrical Engineers.

The examining board has made the following awards in connection with the sixth annual competition for the W. E. Highfield Shield and prizes:—

Members.—1st prize (£5), presented by Messrs. British Thomson-Houston Co., Ltd., B. C. Garman (London), for his paper, "Electric Heating Applied to Small Houses"; 2nd prize (£4 4s.), Messrs. Callender's Cable & Construction Co., Ltd., G. H. Conway (Archaracle), "Labour Unit Costing"; 3rd prize (£2 2s.), Messrs. Siemens Bros. & Co., Ltd., R. W. Whitley (London), "The A.S.E.E. and the Apprentice."

Associates.—1st prize (£4 4s.), The General Electric Co., Ltd., F. Anderson (Glasgow), "The Testing of Transformers"; 2nd prize (£2 2s.), Editor of *Electricity*, A. Simpson (Sunderland), "A Battery-booster Set for an Industrial Electric Plant."

Mr. B. C. Garman, the winner of the members' first prize, is also the winner of the Shield, and will be the proud possessor of this trophy for one year. The Shield and prizes, along with suitable certificates, will be presented to the winners at the opening meeting of the 1928-29 session in October next.

Welded Steel Tubular Transmission-line Poles.

The Swiss Federal Railways are employing a new type of mild-steel tubular pole, invented by Messrs. Sulzer Bros., for carrying high-pressure lines. The cross-section of the pole is oval at the base, decreasing gradually and regularly towards the top, where the cross-section is circular. The pole is constructed of several separate sections, each formed from a single piece of plate cut to a trapezoid, pressed into a tube of the desired cross-section, and then welded. Not more than four or five sections are required to construct poles 50 to 70 ft. high. These poles are used as line supporting poles; they can also be used at corners and as terminal poles. At 40 to 60 ft. above ground level, arms made of pressed mild-steel plate welded to steel shoes are fixed to the pole by means of stirrup bolts. The top of the pole is closed by a cap which carries the earth line. In order to avoid as far as possible the necessity for carrying out painting and repair work in the danger zone, close to the high-pressure lines, the upper part of each pole is galvanised by the metal spraying process, the rest of the pole being painted with red lead and oil paint, while the inside is tarred by a special process. Each pole is set in a recess provided in a concrete block 6 to 8 ft. deep, poured direct into a hole in the ground, the pole being afterwards cemented in place. It is claimed that the patented method of constructing the poles allows them to be given a shape approximating to that theoretically required by bodies of uniform strength. The oval cross-section allows the greatest moment of resistance always to correspond to the line of highest stress; the moment of resistance is at a maximum along the major axis, and at a minimum along the minor axis. After manufacture each pole is tested to about 10 tons per sq. in. by fixing one end and loading the other.

The shape of the poles affords no niches or crevices for the collection of water or dust, so that they keep clean for a considerable time. The shape also permits of rapid and economical repainting when necessary, and the simplicity of outline is said to avoid disfigurement of the landscape. During the past few months some thousands of these poles have been supplied by Messrs. Sulzer Bros. for 60,000-volt transmission, extending over a distance of about 125 miles on the Swiss Federal Railway system.

Measuring Infinitesimal Elongation Electrically.

Equipment to measure changes in length of the order of a thousand-millionth of an inch has recently been devised by Mr. P. P. Cioffi, of the Bell Telephone Laboratories. The need for so refined an instrument arose in studies of magnetic materials; it was designed to measure changes of length in a piece of wire about 4 in. long. One end of the 4-in. section is fixed in position and to the other end a clamp is attached which connects to the short arm of a lever. The long arm of this lever tips a concave mirror as the wire changes its length. Light from an incandescent lamp, after passing through a suitable lens, falls on the mirror at a small angle from the perpendicular and is reflected back to a position somewhat offset from the lamp where a photo-electric cell is mounted. Between the light source and the mirror is a grating with alternate opaque and transparent lines, each ½ mm. thick. The image of this grating falls on the mirror and is reflected back to an extension of the same grating in front of the photo-electric cell. When the images of the transparent lines are reflected back to another group of transparent lines, full light will fall on the cell. When, on the other hand, they fall on the opaque lines no light will be transmitted. Only a very small movement of the mirror is required to cause this change from full light to no light. The photo-electric cell gives off a current proportional to the light falling on it, and this current is indicated by a sensitive galvanometer. The galvanometer indication thus serves to divide the width of one bar of the grating into a large number of smaller divisions.—*Electrical World.*

New Power Station at Guildford.

On Wednesday last week the new electricity works of the Guildford Corporation, at Woodbridge Road, was officially inaugurated by the Mayor of Guildford, Councillor W. R. Philpot, J.P., and in honour of the occasion a luncheon was given to members of the Corporation and friends by Messrs. C. A. Parsons & Co., Ltd., the main contractors for the new station. We hope to be able to deal more fully with the station in a later issue, but, briefly, it has an initial capacity of 6,000 kW. two 1,500- and one 3,000-kW turbo-alternators being installed. Provision is made for an ultimate capacity of 42,000 kW. There are also installed two Stirling patent tri-drum water-tube boilers, each with a normal evaporating capacity of 40,000 lb. per hour, at 290 lb. per sq. in., 750 deg. F. The generation system is three-phase, 50 cycles, 6,600 volts. The station has been erected at a cost of about £140,000.

At the luncheon, at which the Hon. Sir Chas. Parsons, O.M., was in the chair, in reply to the toast of "The Mayor and Corporation" by Mr. S. F. Prest, of Messrs. C. A. Parsons & Co., Ltd., the Mayor of Guildford said that at Guildford their hopes were a little damped at first by the national electricity scheme, but there existed between the town and the Central Electricity Board a very happy feeling.

Mr. F. W. Purse, president of the Incorporated Municipal Electrical Association, in proposing "Guildford Electricity," commended the Corporation for embarking upon a new station, and also on the station being "non-selected." A number of engineers had had the idea that it was a wonderful thing for a station to be "selected," but they were now beginning to come round to the view that the advantages were not overwhelming. At West Ham the station was "selected," but they did not regard it as an advantage. They had taken counsel's opinion and found that the advantages and disadvantages were about equal. Guildford would be able to run its "non-selected" station free from restrictions, so long as it was able to generate electricity at a lower price than the Central Electricity Board could supply it for. In replying to Mr. Purse, Alderman J. B. Rapkins, chairman of the Electricity Committee, read a letter from Sir John Snell, chairman of the Electricity Commissioners, who assured Guildford that as the result of its station being "non-selected" the undertaking would not suffer. Mr. G. W. Spencer Hawes, the consulting engineer for the station, and Mr. W. E. Affleck, the borough electrical engineer, also spoke, and a vote of thanks was passed to Sir Charles and Lady Parsons.

Association of Mining Electrical Engineers.

The annual general meeting of the South Wales Branch of the Association of Mining Electrical Engineers was held at Porthcawl on June 2nd, when Major E. Ivor David, branch chairman, presided over the formal meeting. In his annual report Mr. H. J. Norton, hon. secretary, said the total membership of the branch in March, 1928, was 416. A special award available to members who were not eligible for the Association's prizes was inaugurated at the beginning of the year for the best paper read throughout the country, and the first recipient was their chairman, Major E. Ivor David. The Association's certificate was becoming more and more important, and would soon be regarded as an essential qualification for mining electrical posts.

Mr. E. D. C. Owens, hon. secretary of the Western Sub-branch, reported that the membership was steadily increasing. In August last they had 69 names on the books, whereas to-day the membership was 106.

The following officials were elected: branch president, Mr. T. S. Thomas, Bedwas; branch vice-presidents, Mr. W. W. Hannah and Sir A. Whitten Brown, K.B.E.; hon. treasurer, Mr. A. C. MacWhirter; and hon. secretary, Mr. H. J. Norton.

Atmospheric Electricity.

If experiments made by three German scientists on Monte Generoso, near Lugano, Switzerland, continue to be successful, it looks as if Nature were going to provide the electrical pressure requisite to "smash the atom," says the *Faraday House Journal*. They use a wide-meshed wire net having an area of several hundred square yards, hung by means of a cable between two mountain peaks at a height of about 250 feet, and supported by long chains of insulators. A spark-gap which could be lengthened until the electrodes were 15 ft. apart was adjusted in a lightning-proof hut made of metal: one of the electrodes was connected with the wire net aerial. During storms sparks jumped across the gap at the rate of about one per second, lasting sometimes for as long as 30 minutes. They hope to attain pressures up to 30 million volts, and scientists are looking forward with great interest to the results of this daring experiment.

A Coal Conference in America.

Between 60 and 70 scientists and fuel technologists in eleven different countries have tentatively accepted invitations to speak, or to read papers, at the second International Conference on Bituminous Coal which will be held at the Carnegie Institute of Technology in Pittsburgh, Pa., U.S.A., during the week of November 19th, 1928. The list includes about forty Europeans whom Dr. Thomas S. Baker, president of Carnegie Institute of Technology, personally invited while making his recent two-months visit to Europe in the interests of the Coal Conference. The purpose of the coming congress is similar to the one held in 1926 by the Carnegie Institute of Technology, *i.e.*, to present the results of recent studies of coal that have to do with improved methods of utilisation and combustion. Upon his return from Europe in April, Dr. Baker expressed the opinion that the second conference would be much larger in scope and importance than the first, and that the number of delegates from foreign countries would be considerably in excess of that at the 1926 meeting, when thirteen different nations were represented.

Appointments Vacant.

Junior technical officer for the Admiralty Experimental Establishment. Junior mains assistant (£220 approximately) for the Watford Corporation Electricity Department. Distribution assistant (£246). Canvasser (£180) for the Cannock U.D.C. Electricity Department. Professor of electrical engineering (approximately £922) for the Egyptian Ministry of Education. Professors of civil, mechanical and electrical engineering for the College of Engineering, Guindy, Madras (Rs. 1,000 per month). Wireless telegraphist for the Government of Iraq for the Basrah wireless station. Three boiler house charge engineers (£350), four junior charge engineers (£300), for the London Power Co., Ltd. Mains electrical engineer for the Calcutta Electric Supply Corporation, Ltd. (640 Rs. monthly). Technical assistant in the consumers' department for the Islington Borough Council Electricity Department. A well-known manufacturer of dynamos and motors requires a representative for the Irish Free State. See advertisement pages to-day.)

Boiler Explosion Report.

The "Report of Preliminary Inquiry" into the cause of the explosion of a water-tube boiler at the power station of the City of Leeds Electricity Department, which occurred on February 1st last, has just been issued. One of the tubes was ruptured, the contents of the boiler escaping through the aperture so formed. The explosion was due to faulty welding of the tube, the sound parts of the weld being insufficient to withstand the repeated stresses imposed upon them. It is thought that the tube was one of the lap-welded iron tubes which were necessarily fitted when the boiler was built on account of the restricted supply of solid-drawn steel tubes at that time (during the war).

The Non-Magnetic Yacht "Carnegie."

The non-magnetic yacht *Carnegie*, of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, resumed on May 1st, from Washington, D.C., the magnetic and electric survey of the oceans. This work was begun during 1905 to 1908 on the chartered brigantine *Galilee* in the then magnetically unexplored Pacific. With the completion of the specially designed yacht *Carnegie* in 1909 the survey was continued with greater efficiency, because of non-magnetic construction of the vessel and of the evolution of suitable instruments and methods, in all oceans during 1909 to 1921.

Cruise VII of the *Carnegie*, to continue for three years during 1928 to 1931, will cover all oceans and will add 110,000 miles to the total of 290,000 miles already traversed by the vessel's first six cruises. Besides continued magnetic and atmospheric-electric investigations as heretofore with improved apparatus, determinations of natural marine electric currents will be attempted, as well as an extensive schedule in physical and biological oceanography.—*Science*.

The Fuel Conference.

Next autumn, from September 24th to October 6th, as previously announced, a Fuel Conference is to be held as a sectional meeting of the World Power Conference, at the Imperial Institute, London. The organisation is in the hands of the British National Committee of the World Power Conference, which has sent us a preliminary announcement as to conditions and privileges of membership.

The hon. president will be the Earl of Balfour, K.G., O.M., and the president Sir Alfred M. Mond, M.P. The chairman of the Fuel Conference Committee is Mr. D. N. Dunlop, and of the Technical Committee Dr. C. H. Lander. Ordinary members will pay a subscription of 30s. (reduced to 20s. for members of participating Institutions and Associations), and can purchase advance copies of the papers if they wish. Official delegates appointed by the member-countries of the World Power Conference are entitled to free membership, and to advance copies of the papers. Arrangements are being made with the railway companies in Great Britain to secure reduced fares for return tickets to London, and the secretaries will endeavour to assist members to obtain hotel accommodation. An Entertainment Committee has been formed, and arrangements will be made for official visits to places of interest to the fuel industry during the Conference, as well as for a special tour after the Conference.

The Conference has the support of Government Departments, Universities, scientific and technical institutions, and industrial and commercial associations, as well as of many eminent engineers and men of science; its work will be distributed amongst 22 sections covering the whole field of production and use of fuel, including the generation, transmission, and utilisation of electricity, and the proceedings will undoubtedly be of great interest to engineers generally.

All applications for membership forms should be made to the Secretaries, Fuel Conference, 1928, World Power Conference, 36, Kingsway, W.C.2.

An International Test-Code for Steam Turbines.

Following up the work accomplished by the International Electrotechnical Commission at its meetings in Italy last September, when agreement was reached regarding a tentative draft specification for steam turbines, a meeting of the Advisory Committee on Steam Turbines was held at The Hague, Holland, from May 21st to May 25th, at which a large number of actual designers of steam turbines, as well as important users, were present. There was a marked degree of unanimity regarding general principles. The Advisory Committee, recognising the inevitable differences in national practice at the present time, endeavoured to draft a set of Rules for Acceptance Tests of Steam Turbines which would represent the best practice, which all National Committees were invited to adopt as and when their national rules came up for revision.

Eight out of the ten countries represented on the Advisory Committee sent delegates; the chair was taken by Professor Feldmann, President of the I.E.C., and Mr. C. le Maistre, the general secretary of the I.E.C., was also present and took considerable part in the meetings. Twenty-five delegates were present, the British delegation consisting of Messrs. J. P. Chittenden, H. L. Guy, W. H. Patchell, I. V. Robinson, T. Roles, F. Samuelson, G. Stoney, M. G. S. Swallow, and J. F. Stanley. Specific proposals for acceptance tests were submitted for consideration by the British, German, Czecho-Slovakian, and United States delegates, the British proposals being based on the report of the Institution of Civil Engineers on tabulating the results of heat-engine and boiler trials. The work of the Committee was largely concerned with the task of collating the data available and assembling them into one comprehensive code; this task was greatly facilitated by the preparatory work of the United States National Committee, which Committee acts as Secretariat to the Advisory Committee on behalf of the I.E.C.

In spite of the very specialised and complex nature of the subject, considerable progress was made, with the aid of several sub-committees. To facilitate the discussions the subject was divided broadly into seven sections, namely: Object and Scope; Definitions; Guiding Principles; Essential Measurements; Instruments and Methods of Measurement; Commutation of Results; and Data and Results. Some of these sections were discussed in detail, while others were only considered from the point of view of broad principles, the drafting of the detailed proposals being left to the American Secretariat in collaboration with an Editing Committee consisting of one delegate each from France, Germany, Great Britain, Switzerland, and the United States.

It is hoped that a further meeting of the Advisory Committee will be held in about a year's time, in London, to consider the full draft of the International Rules for Acceptance Tests, which will in the meantime have been considered by each National Committee.

The delegates were entertained by the Dutch Electrotechnical Committee, and a highly interesting excursion was made by steamer from Leyden to Aalsmeer, the centre of the Dutch flower and vegetable gardens and market. On the following day the delegates were entertained at a dinner, and a return luncheon to the Dutch Committee was given by the visiting delegates on the Friday. Many of the delegates were accompanied by ladies, and during the technical meetings the ladies were entertained by a special Reception Committee.

Lightning Protection by Buildings.

According to *Science-Supplement* investigations by Mr. F. W. Peck, of the General Electric Co. (America), have shown that tall buildings and lightning rods mounted on high towers protect neighbouring structures from lightning, provided they are not so high as to extend out of the cone of protection, which extends around the base of the high building for a distance of between two and four times its height.

Institution Notes.

Institution of Electrical Engineers.

ELECTION OF COUNCIL.—The following have been nominated by the Council for the vacancies which will occur on the Council on September 30th:—*President*: Lieut.-Col. K. Edgcumbe, R.E.(T.A.); *vice-presidents*: Mr. P. V. Hunter, C.B.E., and Dr. A. H. Railing; *hon. treasurer*: Lieut.-Col. F. A. Cortez Leigh, T.D., R.E.(T.) (Ret.); *ordinary members of council—Members*: Messrs. J. M. Kennedy*, R. K. Morcom, C.B.E., M.A., C. C. Paterson, O.B.E., F. W. Purse,* E. H. Shaughnessy, O.B.E., and Lieut.-Col. W. A. Vignoles,* D.S.O. *Associate members*: Messrs. T. G. N. Haldane,* M.A., and S. Harcombe,* M.A., B.Sc. *Associate*: Sir Philip A. M. Nash,* K.C.M.G., C.B. (*Has not previously served on the council in any capacity.) It is competent for Members and Associate Members to nominate other qualified persons to fill the above vacancies, not later than June 21st.

SOUTH-MIDLAND CENTRE.—A local summer meeting has been arranged for Tuesday, July 10th, 1928, including a visit to the works of the D. P. Battery Co., Ltd., Bakewell, Derbyshire. Old water-wheel drives 100 years old will be open for inspection, and due entirely to the efforts of Mr. A. D. Phillips, member of Committee, a direct invitation from the Duke of Rutland has been received to visit Haddon Hall; the party will be restricted and tickets will be allocated to the first 100 applicants; the remainder will be taken to see the Druids ruins at Bichover. On the way to Matlock a call will be made at the Derbyshire and Nottinghamshire Electric Power Co.'s outdoor sub-station, Ambergate, and lunch will be served at the Royal Hotel, Matlock Bath. Light refreshments will be served on the return journey to Birmingham, in the charabancs. Tea will be provided by the D.P. Battery Co. at Bakewell.

British Institute of Radiology.

ELECTION OF OFFICERS.—The following officers and council of the British Institute of Radiology, incorporated with the Röntgen Society, for the 1928-29 session will take office in October next:—*President*: G. W. C. Kaye; *vice-presidents*: Sir W. H. Bragg, Robert Knox, L. A. Rowden; *hon. treasurer*: Geoffrey Pearce; *hon. secretaries*: Stanley Melville, G. Shearer; *hon. editors*: Robert Knox, G. W. C. Kaye; *council*: C. Andrews, A. E. Barclay, G. B. Batten, R. M. Beath, J. A. Crowther, N. S. Finzi, C. T. Holland, F. L. Hopwood, J. E. A. Lynham, D. McGrigor, C. E. S. Phillips, S. Russ, W. E. Schall, S. G. Scott, G. Stead, A. M. Tyndall, J. Duncan White, R. S. Wright, with nominee of each branch and two representatives of the Society of Radiographers.

Royal Institution.

At a general meeting on Monday afternoon last the special thanks of the members were returned to the Council of the Institution of Electrical Engineers for their gift of a portrait of Faraday after the painting by Mr. George Harcourt, R.A.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Birthday Honours.—The profession and industry that this journal represents are only indirectly touched by the list of Honours conferred in celebration of His Majesty's Birthday. The public services of Sir G. Rowland Blades, Bart., as Lord Mayor of London and as president of the Federation of British Industries, and the prominent place occupied by Sir Alfred Mond in industrial affairs, have been recognised by their elevation to the Peerage. The third new peer—Sir J. F. Remnant, Bart.—claims mention here because he is a director of the Westminster and Central Electric Supply Companies. Mr. J. M. A. Gatti, who receives the honour of knighthood, in addition to being president of the British Electrical Development Association and managing director of the Charing Cross Electricity Supply Co., Ltd., is an ex-chairman of the L.C.C. Dr. J. A. Hosker, also one of the new knights, is chairman of the Bournemouth and Poole Electricity Supply Co., Ltd., and a director of the County of London and other companies. Knighthoods are also conferred upon Mr. Gilbert C. Vyle, the very popular president of the Association of British Chambers of Commerce and managing director of W. & T. Avery; Dr. J. Hopwood Jeans, F.R.S., the secretary of the Royal Society; Mr. B. H. Morgan, of the British Empire Producers' Organisation; and Mr. Henry Walker, C.B.E., H.M. Chief Inspector of Mines. Mr. R. W. Dalton, H.M. Senior Trade Commissioner in the Commonwealth of Australia, receives the C.M.G. (in the Dominions Office List). Prof. J. S. Haldane, M.D., F.R.S., director of the Mining Research Laboratory of Birmingham University, is appointed a Companion of Honour for scientific work in connection with industrial disease. The C.B.E. (Civil Division) is awarded to Dr. C. H. Lander, director of Fuel Research in the Department of Scientific and Industrial Research, and the O.B.E. (Civil Division) to Mr. D. N. Dunlop, director of the B.E.A.M.A., to Commander F. G. Loring, R.N. (Ret.), Inspector of Wireless Telegraphy, G.P.O., and to Mr. G. H. Wright, secretary of the Birmingham Chamber of Commerce. The M.B.E. (Civil Division) is conferred upon Mr. J. D. Brown, Traffic Accountant to the Pacific Cable Board. The Indian awards include the M.B.E. (Civil Division) to Mr. F. W. Wilson, executive electrical engineer and electrical inspector to the Government at Bombay, and to Mr. W. H. King, assistant engineer, Post and Telegraph Service. Mr. M. G. Simpson, director-in-chief of the Indo-European Telegraph Department, receives the C.S.I.

Mr. S. J. WATSON has resigned his position as chief engineer with the London and Home Counties Joint Electricity Authority, 5, Millbank, S.W., on appointment by the Central Electricity Board as district engineer for South-East England. His address is now: Central Electricity Board, District Office for South-East England, Trafalgar Buildings, 1, Charing Cross, W.C.2.

The Leyton Town Council has appointed Mr. JOHN WETHERILL, of Barnsley, as electrical engineer at a salary of £900 per annum, rising by annual increments of £50 to £1,050.

Sir HUGO HIRST, Bart., has accepted the presidency of the Incorporated Society of British Advertisers for the year 1928-29.

The *Electrical World* reports that Mr. CHARLES F. BRUSH was presented with the Franklin Medal by the Franklin Institute of Philadelphia on May 16th.

After 43 years' service, Mr. T. B. JOHNSON, superintendent engineer of the North-Eastern District of telephones and telegraphs, retired last week. For some years he has been stationed at Leeds, and was closely associated with the establishment of the first automatic telephone exchange.

Mr. W. D. FISHER, for eight years mains superintendent in the Wigan Electricity Department, has been appointed assistant engineer and manager to the Wessex Electricity Supply Co., and will be stationed at Oxford.

The Hull Corporation Electricity Committee met last week to consider the appointment of borough electrical engineer to follow Major HERBERT BELL, who had been recommended for the Glasgow chief engineership. Major Bell's salary was £1,100, and it was moved that £1,500 be offered for a new man; the chairman considered that £2,000 would not be too much. Amendments were moved, and as a result three voted for £1,100 and one against. The chairman did not vote as he preferred to leave the responsibility for fixing the salary with the City Council.

Col. W. H. FRANKLIN, C.B.E., D.S.O., Trade Commissioner in East Africa, will be in attendance at the offices of the Department of Overseas Trade for two weeks, commencing June 4th. Applications for interviews with Col. Franklin should be addressed at once to the Comptroller-General Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference 4311/1/28.)

Mr. DAVID BAKER, of Messrs. Baker-Rickards, electrical and wireless dealers, Handsworth, Birmingham, was married to Miss C. A. Gladstone on May 27th.

Mr. G. E. GREEN, senior partner in the firm of George Green and Co. ("Gee Gee" water heaters) was married on June 4th to Miss Q. F. COPPEN, secretary to the same firm, who is an active member of the E.A.W. and a lecturer on water heating. Mr. LESLIE A. BOOTH, late technical engineer to the Norris Warming Co., Ltd., has joined Messrs. Green as sales manager.

The EARL OF VERULAM, chairman of the Enfield Cable Works, Ltd., has been elected chairman of Sir W. G. Armstrong, Whitworth & Co., Ltd.

Obituary.—MR. W. CLAUDE JOHNSON.—We regret to record the death of Mr. Walter Claude Johnson, M.Inst.C.E., whose retirement from the chairmanship of Messrs. Johnson and Phillips, Ltd., was announced at the annual meeting of the company on May 3rd. Mr. Johnson passed away on June 2nd at Broadstone Place, Coleman's Hatch, Sussex, in his 81st year. We gave a full account of the deceased gentleman's career in the ELECTRICAL REVIEW for May 4th, page 791.

MR. H. ADAMS.—The death is announced, at the age of 67 years, of Mr. Herbert Adams, who was the founder of the firm of H. Adams & Co., radio engineers, Reading.

Wills.—The late Mr. G. HARLAND BOWDEN, M.I.E.E., left £1,301 gross and £201 net personalty.

The late Mr. FREDERICK WILLIAM REID, Kirkwall, Orkney, formerly an engineer with the Eastern Telegraph Co., Ltd., left, in addition to real estate, personal estate valued at £38,855.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

British Radio Gramophone Co., Ltd.—Registered as a public company on May 25th. Nominal capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in gramophones, wireless and electrical apparatus, musical instruments, &c. The directors are:—H. G. Eastcott, The Orchard, Winchmore Hill, N.21, sales manager; F. W. B. Walker, 49, Lupus Street, S.W.1, accountant. Registered office: 14-18, Holborn, E.C.1.

International Gramophone Co., Ltd.—Private company. Registered May 25th. Nominal capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in gramophones and/or phonographs and records, musical instruments and electrical equipment and appliances of all kinds, &c. The subscribers are:—C. R. Cran, 64, South Audley Street, W.1, solicitor, and W. R. Burrows, 26, Alpha Street, Slough, Bucks., solicitor's managing clerk. The first directors are to be appointed by the subscribers. Registered office: 15-17, Eldon Street, E.C.2.

Red Triangle Electric Co., Ltd.—Private company. Registered May 12th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical and radio engineers, &c. The permanent directors are:—E. Batty (permanent chairman), O.B.E., Copley Dene, Shepperton; J. Bolsom, 123, Westminster Bridge Road, S.W.; T. F. Shearer, 27, St. George's Road, Palmers Green, N.13; A. E. Chapman, 125, Stanley Park Road, Carshalton, Surrey; L. C. Green, 57, Oakley Road, N.1. The said J. Bolsom and A. E. Chapman are to be permanent joint managing directors. Secretary: A. E. Chapman.

Irish Electromedical Co., Ltd.—Private company. Registered in Dublin on May 16th. Capital, £1,000 in £1 shares. Objects:—To carry on business as electricians, electrical contractors, electrical and mechanical engineers, &c. The directors are: G. P. Griffiths, electrical engineer, and Maria E. Griffiths, 94, Sanford Road, Dublin.

William Kemp & Co., Ltd.—Private company. Registered May 23rd, in Edinburgh. Capital, £12,000 in 2,500 preference and 9,500 ordinary shares of £1 each. Objects: To acquire the business of ironmongers and electrical engineers, now carried on by William Kemp & Company, 159, Buchanan Street, Glasgow. The first directors are: W. Kemp, 60, Kirkcaldy Road, Glasgow, J. G. Baillie, 27, Ormonde Drive, Muirend, Glasgow, and L. Kemp, 181, Nithesdale Road, Glasgow, ironmongers. Qualification: 100 preference shares. Registered office: 159, Buchanan Street, Glasgow, C.1.

Dualite, Ltd.—Private company. Registered May 24th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in lighting and heating specialities and appliances used in connection with electric lighting, gas and oil, glass, glassware, electrical and wireless plant and apparatus, &c. The subscribers (each with one share) are: H. J. Smith, 33, St. Luke's Road, Paddington, W.11, clerk; F. R. Collison, 40, Clarence Road, South Tottenham, N.15, clerk. Registered office: 18, Bartlett's Buildings, Holborn Circus, E.C.1.

Burgoyne Manufacturing Co., Ltd.—Private company. Registered May 29th. Capital, £500 in £1 shares. Objects: To adopt an agreement with A. Levenson, and to carry on the business of manufacturers and erectors of wireless and telegraphic and telephonic apparatus, valves, instruments, equipment, accessories, and electrical, magnetic, and radioactive instruments, &c. The first directors are: E. D. Parsons, 9, Clarges Street, W.1, merchant and broker; M. Gray, Belmont, New Bedford Road, Luton, hat manufacturer; C. Edwards, 107, Sinclair Road, W.14, electrical engineer; H. K. Smith, 28, Holland Park, W.11, agent; E. D. Hine, 58, Lyford Road, S.W.18, surveyor (all permanent, subject to each holding one share). Secretary: F. E. Metters. Registered office: 115, Cannon Street, E.C.2.

Radiovisor Parent, Ltd.—Registered as a public company on May 31st, with a nominal capital of £276,500 in 253,000 10 per cent. participating preference shares of £1 each and 470,000 ordinary shares of 1s. each. Objects:—To acquire the undertaking of Radiovisor, Ltd., including the trade mark "Radiovisor," and to carry on the business of manufacturers, repairers, importers and exporters of, and dealers in, selenium and other light sensitive cells, bridges and apparatus, and applications of these, &c. The directors are:—J. Neale, 15, Acacia Road, N.W.8, civil engineer (permanent chairman); Hon. A. C. Murray, 10, Ennismore Gardens, S.W.7, director of L. & N.E. Railway (vice-chairman for five years); J. W. E. Avern, 60, Madrid Road, S.W.13 (director of Radiovisor, Ltd.); C. L. F. Clutterbuck, 17, St. James' Avenue, Brighton (engineer and general manager of the above company); W. H. Kinnersley, 22, Hurle Crescent, Clifton, Bristol (Kinnersley Bros., Ltd.); F. R. Nutting, "Fernbank," Clevedon, Somerset (director of Radiovisor, Ltd.). Registered office: 26, Church Street, Cambridge Circus, W.1.

Pondac (Electric), Ltd.—Private company. Registered June 1st. Capital, £100 in £1 shares. Objects:—To carry on the business of electrical engineers and contractors, suppliers of all electrical and wireless components and accessories, &c. The directors are:—T. H. Isted, 24, Wyndham Road, West Ealing, W. (director Pondac, Ltd., &c.); C. F. Munn, 18, Knollys Road, Streatham Hill, S.W. Registered office: 44, Praed Street, W.2.

Official Returns of Electrical Companies.

James Keith & Blackman Co., Ltd.—Satisfaction in full on May 15th, 1928, of debentures dated May 31st, 1907, to July 3rd, 1923, securing £2,250.

Attaix, Ltd.—Satisfaction in full on May 15th, 1928, of charge dated July 6th, 1927, debenture dated August 23rd, 1927, and debenture dated March 30th, 1927, securing all moneys not exceeding £500, £400, and £500 respectively.

Debenture dated May 16th, 1928, to secure £7,000, charged on 106, High Street, Southampton, and the company's undertaking and property, present and future, including uncalled capital. Holders: Lloyd's Bank, Ltd.

Miller's Radio Products, Ltd.—R. C. Fletcher, C.A., of 2 and 3, Duke Street, St. James, S.W., was appointed receiver and manager by Order of Court dated April 20th, 1928.

David Thomas, Ltd.—Capital, £25,000 in £1 shares. Return dated May 3rd, 1928. 18,002 shares taken up. £2 paid, £18,000 considered as paid. Mortgages and charges, nil.

Gilbert Productions, Ltd.—Capital, £3,000 in £1 shares. Return dated October 17th, 1927 (filed April 25th, 1928). 2,191 shares taken up. £504 paid, £1,687 considered as paid. Mortgages and charges, nil.

Crossley Bros., Ltd.—Capital, £1,492,293 in 403,390 preference shares of £1 each, 1,015,414 ordinary shares of 10s. each, and 581,196 £1 unclassified shares. Return dated March 8th, 1928. 403,390 preference and 1,015,414 ordinary shares taken up. £405,700 paid on 278,200 preference and 225,000 ordinary shares. £505,397 considered as paid on 125,190 preference and 760,414 ordinary shares. Mortgages and charges, nil.

Electrical Contracts and Maintenance Co. (1925), Ltd.—Capital, £3,000 in £1 shares. Return dated April 17th, 1928. 2,305 shares taken up. £2,305 paid. Mortgages and charges: £250.

British Insulated Cables (S.A.), Ltd.—Capital, £2,000 in £1 shares. Return dated April 2nd, 1928. All shares taken up. £2,000 paid. Mortages and charges, nil.

Electrical Distribution of Yorkshire, Ltd.—Capital, £1,000,000 in £1 shares. Return dated March 20th, 1928. 800,000 shares taken up. £800,000 paid. Mortgages and charges, nil.

Cambridge Electric Supply Co., Ltd.—Capital, £260,000 in £1 shares. Return dated April 17th, 1928. All shares taken up. £215,000 paid (being £1 per share on 210,000 and 2s. per share on 50,000 shares). Mortgages and charges: £30,000.

E. Benington & Son, Ltd.—Capital, £10,000 in £1 shares. Return dated March 16th, 1927. 4,259 shares taken up. £3,103 paid, £1,156 considered as paid. Mortgages and charges: £1,000.

Tyneside Supplies, Ltd.—Capital, £200 in £1 shares. No return or list of allotments filed. No mortgages or charges registered to May 26th, 1928.

Magnoid (Bristol), Ltd.—Capital, £1,000 in 600 preference and 400 ordinary shares of £1 each. Return dated April 23rd, 1928. All shares taken up. £400 paid on the ordinary shares, £600 considered as paid on the preference shares. Mortgages and charges, nil.

Vio Ray Electric Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1927 (filed March 19th, 1928). 377 shares taken up. £377 paid. Mortgages and charges, nil.

County of Durham Electrical Power Distribution Co., Ltd.—Capital, £535,000 in £1 shares. Return dated April 4th, 1928. All shares taken up. £535,000 paid. Mortgages and charges: £250,000.

Hindle, Son & Co., Ltd.—Capital, £15,000 in 10,000 ordinary and 5,000 deferred shares of £1 each. Return dated March 9th, 1927 (filed April 3rd, 1928). 4,100 ordinary and 5,000 deferred shares taken up. £4,000 paid, £100 calls in arrears, £5,000 considered as paid. Mortgages and charges, nil.

British General Radio Co., Ltd.—Capital, £3,000 in 4,000 ordinary shares of 5s. each and 2,000 preference shares of £1 each. Return dated February 14th, 1928. 4,000 ordinary and 2 preference shares taken up. £2 paid, £1,000 considered as paid. Mortgages and charges: £1,000 (£800 issued).

"Sel-Ezi" Wireless Supply Co., Ltd.—Capital, £500 in 400 preference shares of £1 each and 2,000 ordinary shares of 1s. each. Return dated April 11th, 1926. 270 preference and 2,000 ordinary shares taken up. £370 paid. Mortgages and charges, nil.

Charles White Electrical Co., Ltd.—Capital, £3,000 in 2,000 "A" and 1,000 "B" shares of £1 each. Return dated February 22nd, 1928. 1,550 "A" and 1,000 "B" shares taken up. £1,050 paid on 50 "A" and 1,000 "B" shares, £1,500 considered as paid on 1,500 "A" shares. Mortgages and charges, nil.

H. J. Cash & Co., Ltd.—Capital, £25,000 in £1 shares. Return dated March 13th, 1928. 15,000 shares taken up. £10,000 paid, £5,000 considered as paid. Mortgages and charges, nil. Return of allotments made up to April 24th, 1928, shows a further 650 ordinary shares allotted, payable in cash, and fully called up.

Burgess Hill and District Electric Supply Co., Ltd.—Capital, £10,000 in 4,000 7 per cent. "A" preference, 3,000 6 per cent. preference, and 3,000 ordinary shares of £1 each. Return dated March 20th, 1928. All shares taken up. £9,900 paid on 4,000 "A" preference, 2,900 preference, and 3,000 ordinary shares, £100 considered as paid on 100 preference shares. Mortgages and charges: £1,200.

Wilfrid Francis & Co., Ltd.—Capital, £1,000 in £1 shares. Return dated March 30th, 1928. 490 shares taken up. £490 paid. Mortgages and charges, nil.

Newcastle and District Electric Lighting Co., Ltd.—Capital, £300,000 in £1 shares. Return dated April 13th, 1928. All shares taken up. £300,000 paid. Mortgages and charges: £309,540.

Key Engineering Co., Ltd.—Capital, £5,000 in 4,993 ordinary and 7 deferred shares of £1 each. Return dated March 14th, 1928. 4,070 ordinary and 7 deferred shares taken up. £4,077 paid. Mortgages and charges: £5,000.

Oswestry Electric Lighting and Power Co., Ltd.—Issue on May 10th, 1928, of £300 debentures, part of a series already registered.

H. G. Law, Ltd.—Capital, £3,000 in 2,985 6 per cent. preference shares of £1 each and 300 ordinary shares of 1s. each. Return dated January 11th, 1928. 2,600 preference and 300 ordinary shares taken up. 3s. paid, £2,614 17s. considered as paid. Mortgages and charges: £400.

Superlamp, Ltd.—Satisfaction in full on May 1st, 1928, of debentures dated August 15th, 1921, securing £1,000.

United Kingdom Manufacturing Co., Ltd.—Satisfaction to the extent of £330 on May 9th, 1928, of debentures dated June 9th, 1927, securing £400.

Multi Wiring and Instrument Co., Ltd.—Debenture dated May 14th, 1928, to secure £50, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. H. Marshall, 47, Lewis Road, Neath.

City Notes.

Electric Supply Corporation, Ltd.

This company's report was reviewed in our last issue (p. 961). Mr. J. G. B. Stone (chairman) presided at the annual meeting on May 31st, and in the course of his speech said that the increase in connections had shown improvement, and the output had risen from 8¼ to 11 million kWh. The bulk of that increase was due to the larger demand of the shipbuilding industry upon the Dumbarton undertaking. The profit had been improved by the reduction of generating costs due to the lower price of coal. A large part of the capital expenditure of £16,108 was on mains extensions; there was an item of £9,824 in connection with a change-over to bulk supply and from d.c. to a.c. at Hitchin. It was provided that that expense, including the cost of changing-over consumers' installations, would be included in the price of the undertaking in the event of its purchase by the local authority, subject to a 5 per cent. sinking fund which had to be provided out of the profits. Reviewing the position of the subsidiary companies, Mr. Stone said that Hendon and Dawlish had declared their usual dividends, and were progressing satisfactorily. The Alton Company commenced to supply in October last from its own generating station: the connections were increasing in a satisfactory manner. The area of the Haywards Heath Company was too extensive for d.c. distribution, and when a bulk supply from the Central Electricity Board became available the system would be altered to a.c. They were in communication with the Electricity Commissioners and the Board as to the quickest means of obtaining the required supply. It was also desired to change the system in the Petersfield district, where a bulk supply from the Plymouth Corporation had been arranged. The company had applied for an extension of its area. The Uckfield Company had supplied gas since 1858, but had to wait until a supply from the Central Board was available before it could supply electricity. In Newhaven and Seaford they had a promising undertaking; a power station had been constructed, mains had been laid, and a supply was commenced a few days ago. Substantial power contracts had been arranged, among them being one in connection with the Southern Railway's Newhaven harbour. The Peterhead Company had almost completed the laying of mains in the town, but it was not likely that the power station would be completed until the end of the year. The Wellington Company had not yet been able to proceed with its work; it had been instructed to obtain a bulk supply, if possible, but so far had been unable to arrange this.

The Corporation had an investment of £113,502 in Government securities which was available for investment in electricity undertakings as and when required. The development account showed a substantial decrease, and there were now no items in the balance sheet in respect of the cost of obtaining capital.

Ever-Ready Co. (Great Britain), Ltd.

The annual meeting of this company, whose report was reviewed in our issue of May 4th (p. 788), was held on May 31st. Mr. H. C. Moller (chairman), who presided, said that the year's trading had created a fresh record. Foreign competition had been greater than ever, and in view of the fact that the company received no assistance from Customs duties or artificial aids, it had done well in securing a larger business than in any previous year. They were led to believe that little or no profit was made either by the manufacturers or importers of foreign competitive goods. The work of the past nine years enabled the company to sell improved articles at lower prices; the improved manufacturing facilities and large production enabled it to make an adequate profit where smaller producers, selling at similar prices, would find it difficult to secure a margin at all. The reserves now amounted to £225,000. It was proposed to "split" the £1 ordinary shares in four 5s. shares each. It was believed that that would encourage retailers of the company's goods to invest in the concern. Should the company need further capital for development it was proposed to offer a proportion of it to registered customers of the company, but preference in the issue price would, of course, be accorded to shareholders. The report and accounts were adopted, and subsequently the sub-division of the ordinary shares was approved.

Rangoon Electric Tramway and Supply Co., Ltd.

The annual meeting was held in Rangoon on April 27th, Mr. W. A. W. Dawn (chairman) presiding. In presenting the report and accounts (*vide* Elec. Rev., April 20th, p. 695) the chairman said that despite a reduction in the charges for lighting and power purposes, the revenue from these sources showed an increase, as compared with 1926. Referring to the introduction of motor-omnibuses in direct competition with the tramway, he said that the main feature about this was that the 'buses had accepted the tramway fares, and that 'buses could not be run at a profit on tramway fares. The loss on the company's vehicles during the year was Rs. 14,387, exclusive of depreciation, and in view of these results it was considered advisable to write all the motor 'buses down to £1 each out of reserves. Reference had been made elsewhere to the probability of the tramways being superseded in the near future by 'buses. He did not share this view, and was convinced that for mass movement of passengers in congested city areas the tramcar was the best method of transportation. With a view to improving the tramway service, and to meeting 'bus competition a number of new equipments to modernise the tramcars and to give a faster service were being installed.

At an extraordinary meeting which followed, the proposal to sub-divide the 50,000 cumulative £5 shares into shares of £1 denomination was adopted.

Underground Electric Railways Co. of London, Ltd.

On Thursday last week this company published an offer for sale in connection with £4,000,000 of 5 per cent. first mortgage debenture stock at the price of £96 per cent. The sale was made subject to a preferential allotment in respect of applications from holders of the company's 4½ per cent. bonds. The bonds, which will constitute a first charge on assets valued at over £12,000,000, will be redeemable at par on May 15th, 1963, at the latest, or in whole or in part at six months' notice at a premium. Holders of the company's 4½ per cent. bonds can exchange these for an equal amount of the new stock plus a cash payment of £4 13s. 4d. per cent. The proceeds of the issue will be devoted to the repayment of the 4½ per cent. bonds and temporary loans outstanding, the balance being employed to adjust the excess expenditure upon capital account and to provide further capital.

Cawnpore Electric Supply Corporation, Ltd.

The accounts of this company were reviewed in our issue of May 25th (p. 918). The annual meeting was held on May 29th, when Mr. J. G. B. Stone, the chairman, said that the electricity generated showed an increase of 22½ per cent. as compared with 1926, and the total amount sold exceeded the 1926 figure by 26¼ per cent. The maximum supply demanded also showed an increase of 7 per cent. Continued steady development was anticipated, and the company would have to be prepared for a big increase in demand for power when industrial conditions improved. The report and accounts were adopted.

Tokio Electric Light Co.

We reported in our last issue that this company was floating loans totalling about £24,500,000 in London, New York, and Japan. The particulars of the British share of the total (£4,500,000) were published on May 31st. The whole of this, in 6 per cent. first mortgage bonds, has been acquired by Messrs. Lazard Bros. & Co., Ltd., and the Whitehall Trust, Ltd., at the price of 84¾ per cent., and is being offered for public subscription at 90 per cent. The holders of the company's existing 6 per cent. bonds (amounting to £3,600,000) are given the option of receiving repayment of their bonds in full or exchanging them for new bonds of equal nominal value plus a cash payment of £10 per cent., representing the difference between the par value of the old bonds and the issue price of the new. The proceeds of the loans are to be used to adjust the company's finances and to provide new money for development.

Cuba Submarine Telegraph Co., Ltd.

The report for the year ended December 31st last shows total receipts of £56,720 (against £58,603 in 1926) and expenses amounting to £33,160 (against £31,250). After providing £5,850 for cable repairs and adding £18,372 brought forward, there remains £36,083. The directors have reduced the value of the investment in the West India and Panama Telegraph Co., Ltd., to £50,000, and are paying a final dividend at the rate of 10 per cent. on the preference shares (making 10 per cent. for the year); a balance of £10,170 is carried forward. In 1926 an interim dividend of 2½ per cent., free of tax, was paid on the ordinary shares.

West India and Panama Telegraph Co., Ltd.

The receipts for the past year totalled £56,522, and the working expenses £54,277, leaving a credit balance of £2,245. After meeting debenture interest, depreciation and renewals there is a deficit of £6,196, which, added to that brought forward, makes a total debit of £127,534.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted :—

Underground Electric Railways Co. of London, Ltd.—23,271 ordinary shares of £1 each fully paid, Nos. 5,327,925 to 5,351,195.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Underground Electric Railways Co. of London, Ltd.—£4,000,000 5 per cent. first mortgage debenture stock, issued at £96 per cent., partly paid and fully paid. 952 ordinary shares of £1 each fully paid, Nos. 5,351,196 to 5,352,147.

United River Plate Telephone Co., Ltd.

The revenue for the year ended December 31st last totalled £2,550,523, and after meeting working expenses and debenture interest there was a profit of £464,016, as compared with £441,455 in the preceding year. It is proposed to pay a final ordinary dividend of 5 per cent., again making 8 per cent. for the year; a balance of £28,416 is carried forward with the previous year's surplus, making £165,002. To finance the great amount of work which is being carried out it is proposed to raise the capital from £7,000,000 to £8,000,000 by the creation of 200,000 shares of £5 each, but it is not intended to make an immediate issue. Meeting : June 12th.

Electric Construction Co., Ltd.

The net profit for the year ended March 31st last was £20,593, as compared with £19,703 in 1926-27. A balance of £14,345 brought forward is added, making £34,938. It is proposed to pay a final dividend at the rate of 9 per cent. per annum (making 7½ per cent. for the year, as in the preceding year), leaving £8,044 to be carried forward. The report states that an increased demand for the company's products was experienced during the latter half of the year. Competition, however, is still severe and prices show little or no improvement. Meeting : June 12th.

Richard Johnson, Clapham & Morris, Ltd.

The report for the year ended March 31st last shows a net profit of £2,678, against £20,077 in the preceding year. To this is added £13,824 brought forward, making £16,502. After the payment of the preference dividend a balance of £12,543 is carried forward. In the preceding year a dividend of 3¾ per cent. was paid on the ordinary shares.

South-Eastern Power and Light Co.

The gross revenue of this company and its subsidiaries for 1927 was $41,669,252 (against $37,359,569) and the amount available for interest and dividends was $21,069,971 (against $17,761,600). Four quarterly dividends each of 25c. per common share have been paid.

Cape Asbestos Co., Ltd.

The directors have declared a dividend of 12½ per cent. on the ordinary shares and an equivalent one on the preference shares out of a net profit of £39,704. The previous year's profit was £36,766 and the ordinary dividend 10 per cent.

Great Northern Telegraph Co., Ltd. (of Denmark).

The annual meeting was held in Copenhagen on May 30th and the directors' proposals for the capitalisation of part of the reserves and the formation of a holding company to control the new shares were approved.

Shawinigan Water and Power Co.

A meeting of the shareholders is to be held on June 26th to consider a resolution increasing the capital stock to 2,600,000 by the creation of 1,000,000 new shares.

Northern Mexico Power and Development Co.

Dividends of 1¾ per cent. on the preference stock and 1 per cent. on the common stock have been declared in respect of the quarter ending June 30th.

Anderston Foundry Co., Ltd.

The net profit for the year ended March 31st last was £11,051, against £7,894 in 1926-27. The dividend is maintained at 6¼ per cent.

W. & T. Avery, Ltd.

An extraordinary general meeting is being held to-day (Friday) to consider a resolution providing for the capitalisation of £225,486 of the reserve with a view to its distribution in the form of £1 ordinary shares among existing shareholders in the proportion of one new share for each two held.

Nova Scotia Light and Power Co.

This company has recently issued $4,000,000 5 per cent. first mortgage 30-year gold notes. Its share capital consists of 750,000 6 per cent. cumulative preference shares and 34,523 ordinary shares of no par value.

Canadian General Electric Co.

A dividend of 1¾ per cent. has been declared on the 7 per cent. preference stock for the quarter ending June 30th.

German Companies.

The *United Electricity Works (Westfalen) Company*, Dortmund, reports that the sales increased from 274.58 million kWh in 1926 to 367.11 million kWh last year. The net profit was 6,804,000 marks, against 5,058,000 marks, and the dividend is 7 per cent., against 6 per cent.

The *Robert Bosch Co.*, Stuttgart, reports a material increase in the turnover, both in Germany and abroad, in 1927. As compared with the loss in 1926, the accounts for 1927 show net profits of 1,570,000 marks, but it is considered necessary to retain the liquid funds for the further development of the undertaking.

Austrian Companies.

The *Felten and Guilleaume Co.*, Vienna, states that the extension of the long-distance cable network and the construction of many suspended railways for passenger traffic in Austria was of great advantage to business last year. The accounts show net profits of 1,720,000 schillings, as compared with 1,350,000 sch. in 1926, and the dividend is raised from 9 to 11 per cent.

The *A.E.G.-Union Electricity Co.*, Vienna, reports net profits of 450,000 schillings for 1927, as compared with 370,000 sch. in the previous year; the dividend is raised from 5 to 6 per cent. This year the company, in conjunction with the other three large Austrian companies, has received orders from the City of Vienna of the value of 33 million schillings.

French Companies.

The *Compagnie Générale d'Electricité* reports net profits of 25,327,000 fr. for 1927; the dividend is 105 fr. per share.

The *Compagnie Française pour l'Exploitation des Procédés Thomson-Houston* reports gross profits of 51,145,000 fr. for 1927, as compared with 62,100,000 fr. in the previous year, the net profit being 17,883,000 fr., against 27,245,000 fr. To this is added 12,326,000 fr. brought forward, and a dividend of 6 per cent. is being paid, against *nil* for 1926.

Stocks and Shares.

MONDAY EVENING.

THE lull in Stock Exchange activity to which reference was made here last week has not been disturbed by subsequent animation. It must be said that most of the markets are in a quiet condition. This does not mean that strength shows any particular abatement amongst the investment stocks and shares. It is a common case that when speculation fades away, the tendency is for purely investment stocks to receive the greater attention, and, as most of the issues with which electricity is connected fall into the investment category, the decline of the gambling fever has benefited, rather than damaged, investment stocks and shares.

Cable Stocks Lower.

Certainly there is a fairly substantial reaction to record in the issues of the cable companies. This is due to a little selling on behalf of people who, having bought at higher prices, have become somewhat nervous in regard to the immediate outlook, and when prices attain the levels reached by the Eastern quartette, it takes as little selling as it does buying to bring about considerable fluctuations in prices. Eastern ordinary has shed ten points, and the shares of the group are 15s. lower. Marconis maintain most of their strength, and with a good deal of pertinacity, for in spite of selling which has been on a fairly large scale, the ordinary are but 1/16 lower at 63s. 9d., while the preference and the debentures are very steady. Canadian Marconis have risen to 30s. 6d., but Marines followed the example of Marconis, and, at 48s. 9d., are 1/16 down.

The Direct West India Cable Company controls the Cuba Submarine Telegraph Company, which practically owns the West India and Panama Telegraph Company. The last-named is proving no good investment at present, and £19,000 has been written off, from revenue, to reduce the value of the holding to £50,000. No dividend is paid on the ordinary shares of the Cuba Company. Great Northern Telegraphs at 40 are ex dividend, and pay 5 per cent. on the money at the current figure.

The Strength of Supply Shares.

Electric Supply Corporation shares have advanced to 55s. on talk of an American group desiring to obtain control. Bournemouth and Poole are also a good feature at 57s. 6d., nor is it necessary to recapitulate the reasons upon which this latest advance is based. County ordinary and City Lights are decidedly good. There is a fair amount of business being done in this section, and prices, as will be seen by a reference to our quotations, are very firmly held. Egham and Staines at 39s., the new at 38s. 6d., show small gains. Midland Counties new improved to 4s. 6d. premium.

New Undergrounds.

The issue of four million pounds of 5 per cent. first debenture stock by the Underground Electric Railways in London achieved immediate success. The subscription lists were open for less than half-an-hour, and it is obvious that the company could have obtained a higher price than the 98¼ which was paid to it by the three issuing houses for stock which the latter resold to the public at 96. Underwriting and other expenses were paid by the issuing houses. Dealings were expected to start on the basis of 1 premium, and large applications received 5 per cent. of their subscriptions. Those people who failed to secure an allotment, or who received less than they desired, should observe that London General Omnibus Company 5 per cent. income debenture stock can be obtained at 98, to give a yield of £5 3s. 9d. per cent. on the money, the security being quite as good as, if not better than, that of the Underground Electric Railways. There is also available a small amount of the same company's 4½ per cent. first debenture at 93¾, the yield in this case being £4 17s. 4d. per cent. Underground shares and bonds are higher on the week, demand being quickened by the satisfactory character of the traffics.

Metropolitan Rumours.

A further improvement in Metropolitan Railway stock has lifted the price to 71. The market attributes the buying, which has brought about this advance, to a revival of the impression that the Metropolitan Railway will be taken over by the Underground group, and in such manner as will provide Metropolitan consolidated stockholders with the equivalent of 80, against the present price of 71. There is, of course, nothing new in the idea, and it will be interesting to see whether the rumours now afloat have any firmer foundation than others which collected round the same theory at the end of last year, turning out, at that time, to be premature. Central London assented ordinary has put on a point, at 71. Districts went back 10s. on account of public attention being transferred to "Mets." London United Tramways 4 per cent. debenture stock retains its 2 points rise of last week. The preference shares of the London and Suburban Traction Company are unchanged at 10s. 6d. Shares can be bought at this price, or at a little cheaper.

Foreign Utilities.

Mexican Light and Power shares have had something of a shake-out, dropping to 82½, this showing a drop of 10 points on the week. The 7 per cent. preferred are also lower at 81: the company's second preference at 2⅜ are ¼ down, Mexicans as a whole being on the heavy side. Brazilian Tractions are in somewhat similarly dull case, the common receding to 59½, and the preferred to 195. Most of the "dollar" stocks, as they are called, have gone ahead during the past week, the outstanding feature being a rise of 18 points in International Telegraph and Telephone shares, which raised the price to 202½. British Columbia Electric Railway stocks remain at their previous levels: the advance particulars are appearing of the new British Columbia Power Company, which is to be issued very shortly, and in which a purchase of "B" shares will be accompanied by an allotment of "A" shares. About a week ago the Premier of British Columbia, Mr. Maclean, warned the Corporation that the latter would have the Government to consider in any proposal for raising charges for the supply of power, light and other services.

Tokio Electric.

An important newcomer this week is the 6 per cent. debenture scrip of the Tokio Electric Company, at 90. Prospectuses were announced as being available to the public in the middle of this week, and a favourable reception appeared to be probable. Japanese Government bonds have been advancing in price of late, and the nervousness engendered by the natural convulsions of recent years is wearing off. The appetite of the stags was whetted by confident talk of the likelihood of a premium on the new Tokio sixes after the allotments appear next week.

The Manufacturing Shares.

Telegraph manufacturing shares are quiet, with Henley's back 2s. 6d. at 5⅞ after their previous substantial rise. Metropolitan-Vickers ordinary rallied 1/16 to 31s. 3d., and General Electrics 1s. to 38s. Radio Corporations shot up suddenly, in the Wall Street Stock Exchange. Telephone Manufacturing have been in some request, up to 7s. The rubber market is quiet, with a rather firmer tendency.

Share List of Electrical Companies.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price June 4, 1928.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14†	15½	2⅞xd	+⅛	... ...
Brompton Ordinary	1	8¾	8½	25/6	—	5 9 10
Charing Cross Ordinary	1	8½	8½	27/-	—	5 3 8
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¾	8¾	26/6	—	5 5 8
City of London	1	10	10	30/9	+1/8	4 11 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	37/6	—	4 5 4
County of London	1	7½	7½	39/-	+1/6	3 17 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	55/-	+½	4 0 0
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	7½	29/6xd	—	5 1 8
London Electric	1	8½	8½	26/6	—	5 5 10
do. do. 6% Pref.	5	6	6	5½	—	5 8 2
Metropolitan	1	8	9	2⅜	—	3 15 9
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Newcastle-on-Tyne Ordinary	1	5	6	27/6	—	4 6 8
do. 5% Pref.	1	5	5	19/6	—	5 2 7
do. 7% Pref.	1	7	7	28/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10⅜	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	8	8	37/-	—	5 3 8
South London	1	8½	8½	26/6	—	5 5 8
South Metropolitan Pref.	1	7	7	1⅛	—	6 3 0
Urban Ordinary	1	7	7	51/3	—	2 14 7
do. 6% Pref.	1	6	6	1⅛	—	5 6 8
Westminster Ordinary	1	8½	8½	27/-	—	5 3 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/3	—	6 9 0
Yorkshire Elec.	1	8	8	93/-	—	4 17 0
Home Rails.						
Central London Ord. Assented	Stock	4	4	72	+1	5 11 1
Metropolitan	,,	3	3	71	+1½	4 4 6
do. District	,,	3½	4	76	−½	5 5 3
Underground Electric	£1	1½	5	27/-	+6d.	3 14 1
do. do. Income	Bonds	6	6	128	+2	4 13 9
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100½	—	5 19 5
do Def.	,,	1½	1½	24½	—	6 3 9
Automatic Telephone	1	10	10	45/-	—	4 9 0
Eastern Extension	10	10	10	20⅜	−¾	*4 16 5
Eastern Tel. Ord.	Stock	10	10	210	−10	*4 15 3
Globe Tel. and T. Ord.	10	10	10	21	−¾	*4 15
do. do. Pref.	10	6	6	11	−⅛	5 9 1
Great Northern Tel.	10	20	20	40xd	—	5 0
Indo-European	25	10	10	42½	—	*5 8
Marconi	10/-	5	—	63/9	−1/16	
Marconi-Marine	1	8¾	12½	2⅞	−1/16	5 6
Oriental Telephone Ord.	1	12	12	52/6	—	*4 9 9
United R. Plate Tel.	5	8	8	11½	−1/8	*3 12 0
Western Telegraph	10	10	10	20⅜	−¾	4 16 5
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8½	—	7 4 8
do. do. 2nd Pref.	5	6	6	8½	—	7 17 4
do. do. 5% Deb.	Stock	5	5	76½	—	6 11 2
British Electric Traction Def. Ord.	,,	—	—	530	—	... ...
do. do. 8% Pref. Ord.	,,	8	7½	124½	—	6 8 6
Brazil Traction	100	6	7	59½	−1	2 18 10
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	94½	—	5 5 9
do. do. Preferred	,,	6½	6½	288	—	*2 6 9
do. do. Deferred	,,	8	8	307	—	*2 12 1
do. do. Deb.	,,	4½	4½	85½	−1	4 19 5
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/6	—	... ...
London United Tram Deb.	Stock	4	4	62½	—	6 8 0
Mexico Trams, 5% Bonds	—	5	5	88½	—	5 13 0
Mexican Light Common	100	Nil	Nil	82½	−10	... ...
do. 7% Pref.	100	Nil	7	81	−3½	8 12 10
do. 1st Bonds	—	5	5	88½	—	5 19 9
Yorkshire (West Riding)	1	Nil	Nil	7/6	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	13	15	67/6	—	*4 9 0
British Aluminium Ord.	1	10	10	47/-	—	*4 5 1
British Elec. Transformer Pref.	1	7	7	18/-	—	7 15 7
British Insulated Ord.	1	15	15	4¾	—	3 13 0
Brush Ord.	1	10	10	29/9	—	6 19 0
Callenders	1	15	—	4¼	—	3 10 9
do. 6½% Pref.	1	6½	6½	23/-	—	5 9 5
Crompton Parkinson Pref. Ord.	1	—	—	17/6	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan	4/-	10	10	12.6	—	3 4 0
do. 5% Deb.	Stock	5	5	90	—	5 11 0
Electric Construction	1	7½	—	31/3	—	4 14 0
Enfield Cable Pref.	1	7½	7½	26/3	+1/8	5 14 3
English Electric	1	Nil	Nil	8/9	—	... ...
do. do. Pref.	1	8	Nil	11/3	—	... ...
Gen. Elec. Pref.	1	6½	6½	25/-	—	5 4 6
do. Ord.	1	7½	—	38/-	+1/-	3 19 0
Henley	1	25	—	5⅞	−⅛	4 3 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	43/9	—	4 11 4
Met.-Vickers Ord.	1	8	6	1⅝	+1/16	3 16 10
do. Pref.	2	8	8	2⅜	—	6 1 11
Siemens Ord.	1	7½	7½	28/9	—	5 4 4
Telegraph Construction	12	10	10	26½	—	*4 10 11

* Dividends paid free of Income Tax.
† 4% of which was Tax Free.

Pulverised-Fuel Developments in the United States.

Notes from the Serial Report of the Prime Movers Committee of the N.E.L.A.

By L. M. JOCKEL, M.I.Mech.E., A.M.I.E.E., F.R.S.A.

THE progress made in the application of pulverised-fuel firing to boilers in the United States and in Canada has been remarkable during the past eight years; the Pulverised Fuel Sub-Committee's Report of 1927 to the Prime Movers Committee of the National Electric Light Association indicates in a brief manner the extent of these developments, and some of the difficulties which have been overcome.

Although developments in Great Britain are necessarily on a more restricted basis, due to various reasons, there can be no doubt that powdered-coal firing has made excellent progress during the last four years, and engineers will certainly have to watch events very closely during the next two or three years if they are conscientiously interested in the commercial efficiency of steam production.

The Serial Report of the Prime Movers Committee, although essentially dealing with American and Canadian practice, is a thoroughly practical document containing information contributed by both users and manufacturers of equipment, and, unlike most of our publications, it gives facts relating not only to successes but to failures as well.

It is well known that power-station engineers in the United States are always willing to exchange and disseminate their ideas and experiences, and not only does the present report bear evidence of this spirit, but, like other N.E.L.A. publications, it also serves a useful purpose in recording facts and data of international engineering interest.

The following notes are in no sense intended to boost American practice, but are merely based upon data and statements contained in the report, and it is hoped they will be of some interest to power-station engineers.

It must be emphasised that the problems which have to be faced in pulverised-fuel firing in the United States are somewhat different to those in Great Britain, and in consequence strict comparisons are very seldom possible.

The difference in the character of the coals utilised is of fundamental importance, the majority of the American plants using coals of a high heat value with a fairly high volatile and a low moisture content, while in this country the fuel generally used has a lower heating value and a higher moisture content, and is of a harder nature.

Then again, the use of large boiler units is a feature of American power-station practice, and apart from the question of load factor, the large unit lends itself admirably to pulverised-fuel firing, while another factor of importance is the concentration of plant in the large urban stations.

In order to visualise the progress of pulverised fuel in the United States and Canada, two tables are given in the opening of the report, and both public utility and private plants have been included, the list being limited to boilers containing not less than 5,000 sq. ft. of heating surface.

The stations in operation, or under construction, using the central-preparation type of plant now number seventy, whilst those similarly using the unit system have reached a total of one hundred and thirty-three.

It must not be assumed, however, that the unit or directly-fired system is superseding the central system, although so far as the smaller stations are concerned it appears that the unit system has made very appreciable headway.

Perhaps the most outstanding development of the unit system is the fact that the first section of the State Line Generating Co.'s station will have five boilers equipped for direct firing, whilst the three extension boilers at Cahokia, each of 18,000 sq. ft., will also be fired on this system.

Even in American practice, however, it appears that there are at present insufficient comparative data available between the two systems for any hard-and-fast conclusions to be drawn; some useful figures should be obtained in the next year or two, when some of the directly-fired plant has been in operation for a sufficient period of time.

In nearly all of the 203 installations given in the tables, the fuel utilised will be a high-grade bituminous coal with a low moisture content, and it is interesting to note that in some cases no driers will be provided, as the surface moisture will be comparatively low.

The fusion temperature of the ash from the coal which it is intended to operate with is also given, and one wishes that such data were available for British coals.

Brief details as to furnace walls, preheaters, burners, &c., are also stated in the tables; it is important to note that water-cooled walls and radiant-type superheaters are finding increasing favour, whilst preheated air for combustion and the turbulent type of burner are improvements that are being incorporated in the design of the newer installations.

Turning now to the text of the report, probably the most valuable information given is that relating to the operation and maintenance of various plant, and no fewer than seventy-six pages, with illustrations and tables, have been contributed to this section by some thirty-one public utility companies.

Such usual American expressions as the "boiler horse-power" and "per cent. rating" are used in the text, and one has to resort to occasional mental calculations when making comparisons with British practice, although it is easy to remember that a 1,000-horse-power boiler contains 10,000 sq. ft. of heating surface, and 100 per cent. rating is about half the normal load.

Then again, when considering such details as the energy consumption of auxiliaries and labour and material costs per ton of fuel, it is well to bear in mind that both the short ton of 2,000 lb. and the normal ton of 2,240 lb. are used in the nomenclature of the subject.

Generally, the use of the large boiler is extending, and units having outputs of 300,000 to 400,000 lb. per hour are in regular operation, whilst the Fordson plant at Detroit has now had a Ladd boiler unit of 26,470 sq. ft. at work for over a year since reconstruction, giving an actual maximum output of 500,000 lb. per hour with pulverised fuel on the central system. Another large boiler of interest is the first unit started up at the Kips Bay station of the New York Steam Corporation, with a continuous output of about 325,000 lb. per hour, and a total boiler, economiser, and air-heater surface of 71,682 sq. ft. The final lay-out is arranged for twelve of these units, and the central system of preparation and firing has been adopted.

With regard to fuel characteristics, the report contains useful proximate analyses of the various coals used, which are generally high-grade bituminous varieties, although in a few instances lignites with a high moisture content are being utilised, notably in the Valmont station of the Colorado Public Service Company. At this station, the coal is actually fired on the central system with some 17 to 20 per cent. of moisture, with an overall boiler unit efficiency of about 85 per cent., but the Colorado lignite is stated to be low in surface moisture, which is removed by the waste-heat driers.

A mere statement of the moisture content of fuels is, of course, no criterion of their behaviour when pulverised and fired, as much depends upon the distribution of the water with regard to the coal substance. The free or surface moisture is, to a certain extent, troublesome with both the central and the directly-fired systems, but hygroscopic moisture need not necessarily be of serious account, and, of course, is usually in physical or chemical combination with the coal.

Lignites containing up to about 30 per cent. of moisture, chiefly in the hygroscopic state, can be successfully utilised with only a slight diminution of combustion efficiency, and due to the soft nature of this class of coal the milling and maintenance costs are usually lower than those of bituminous grades.

Furnace construction appears to be undergoing continuous changes, and there is every indication that the hollow air-cooled wall will eventually give way to the water- or steam-cooled design, with either protected tubes or exposed metal cooling surfaces. There will probably be exceptions to these designs when very low-volatile fuels such as coke and anthracite are burned.

Although various types of water- and steam-cooled walls have been evolved since 1924, when the Murray fin-tube was applied to a stoker-fired boiler, there is at present no very definite consensus of opinion available as to the merits and demerits of the various types which are being tried out. Notes on the furnace conditions of the 1,300-lb. pressure boiler at Lakeside, Milwaukee, are given, and the all-metal-lined furnace with both water and steam cooling has given excellent results. No combustion difficulties have arisen even with low ratings, and 16½ per cent. CO_2 has been regularly maintained with very low combustible losses in the flue gas and the ash.

The extraordinary high rate of combustion of the large Fordson boiler at Detroit is due to the introduction of water-cooled walls and radiant superheaters when the unit was rebuilt in 1926, and several operating companies have already indicated that maintenance costs are appreciably lower with metal walls than with refractories.

Preheated air is being more extensively utilised, and the original idea of hollow-wall preheating is showing a tendency to decline, in view of the advent of metal walls and the demand for higher air temperatures, to ensure improved combustion and shorter flame length. One or more unit-type preheaters are being adopted in the gas circuits, and in some cases no economiser is provided, the feed-water being heated with bled steam. Preheated air is also being used in the coal driers in some installations.

With regard to burners, considerable headway has been reported in the design and application of turbulent types, with a view to securing improved combustion and a reduction of furnace volume.

There are already nearly a dozen different types of turbulent burner on the market, and the majority of these are more or less horizontally mounted, giving a flame length considerably shorter than the older types of vertically-mounted burners. In addition to better mixing of the fuel and air, the new types of turbulent burner can handle much greater quantities of fuel per hour, and claims are now made for capacities of from 100 to 150 million B.th.u. per burner-hour.

It is essential with these new burners to prevent flame impingement at such high ratings, and there is also the possibility of unburned carbon losses when firing with comparatively short horizontal flames, although with preheated air this difficulty can be overcome. There is every indication that the turbulent type of burner is making greater headway than the older stream-line types, and noticeable reductions in furnace volume are being incorporated in the newer boiler installations.

The report contains quite a lot of useful data with regard to the energy consumption of auxiliaries, and operation and maintenance costs, although the figures vary greatly in different localities, depending largely on the class of fuel utilised, and the type of plant employed. Unfortunately, the figures are not strictly applicable to British practice, as indicated earlier in this article.

The subject of boiler efficiency is not so prominent in the report as one might have expected it to be, for on this side of the Atlantic we have heard so much about high boiler efficiencies in America that one naturally expects figures of the order of 90 per cent. and upwards. However, it is pleasing to think that sanity in these matters now prevails, and authentic test figures of from, say, 83 to 90 per cent. overall efficiency on the gross calorific value of the fuel as fired are more commonplace. The fact that the report contains some interesting boiler plant test results on long-hour runs adds considerably to its usefulness, although the tabular statements of operating efficiencies over monthly and yearly periods are probably more valuable.

Finally, with regard to ash and dust nuisance, most of the new plant has either sufficiently tall chimneys to prevent localised precipitation, or else catchers are incorporated in the equipment. The electrical precipitation process is, however, being tried out in one or two stations, with a fair amount of success.

Alternating-Current for Driving Machine Tools.

Writing in the *American Machinist*, Mr. R. N. Piper says that each year sees a greater amount of privately owned direct-current power plant abandoned because cheap alternating current is available from the large central stations. Additional savings are realised because a.c. constant-speed motors can be purchased at approximately one-half the price of variable-speed d.c. motors, and their is no comparison in maintenance costs between the simple a.c. motor and the d.c. motor with its commutator and brushes.

This rapid changing-over from direct current to alternating current has had a large influence on machine-tool design. Machine tools have been developed for constant-speed a.c. motor drive that have all the flexibility of those driven by variable-speed motors. Gear trains have been worker out that give more speed changes over a wider range and with fewer gears than ever before. Heat-treated alloy-steel gears and heat-treated alloy-steel shafts mounted on anti-friction bearings and automatically oiled have replaced machine-steel gears, cold-rolled shafts and other unreliable and old-fashioned components.

Consideration of the resale value of equipment has also given impetus to the movement toward constant-speed drives. The market for equipment which can be used in any shop is obviously much greater than for tools which can be used only with a direct-current variable-speed motor.

This tendency is reflected in the newest products of progressive machine-tool builders; for the variable-speed motor, even when used with black gears, does not provide a sufficient range of speeds for many purposes. Economy is sacrificed if the variation in motor speed is more than 3 to 1, and a variation of more than 6 to 1 is rarely attempted. In the modern machine tool, convenience and flexibility are obtained by new methods of securing many changes of speed and feed.

Tendencies in the Electrical Trade.

The B.E.A.M.A. Survey and Forecast.

THE latest of the quarterly surveys produced by the British Electrical and Allied Manufacturers' Association (5s. net) deals with the period from July, 1927, to April last. Reviewing the general economic position during that time, it is noted that financial stabilisation has made further progress in Europe. Attention is drawn to some of the causes of the depression in our basic industries; the steady credit restriction policy of the Bank, the unbroken period of deflation, and the heavy burden of taxation receive the principal blame. The Government's rating-relief proposals are welcomed, but it is pointed out that what is more necessary is a cessation of the diversion of money raised by taxation into non-productive channels.

Up to about eighteen months ago the surplus capital of the United States was invested in foreign loans floated in New York. There has recently been manifest a tendency to purchase European securities directly in the respective stock exchanges, and in certain cases this movement has originated in a desire to obtain some form of control over industrial concerns, but as a rule investment has been purely speculative. "Its influence cannot be regarded as entirely satisfactory: share values have gone up enormously, especially in electrical manufacture and electricity supply securities, and something like inflation has occurred in the market valuation of the capital invested in entire industries, especially those belonging to the newer categories. One result of this dabbling in futures has been that the actual return upon capital, as valued on the Stock Exchange, becomes exceedingly low, and there is almost an obligation on the part of the industrial firm to justify the valuation by realisation of higher dividends. The development may never take place, but it has its effect on industrial policy." Again, these artificial valuations lead labour, local authorities, and large consumers generally to think that they are being exploited. It is considered that there are very few signs of an industrial revival which will justify the abnormal speculation referred to. On the other had, the international stagnation is likely to continue. After touching upon the causes, the survey points to a definite upward movement in Continental wage levels from which the British manufacturer may benefit, although in the meantime acute disturbances may affect international economic activity.

Reference is made to the continued movement towards larger manufacturing groups and cartels. Recent developments have shown that one large manufacturing group is already defined in British electrical engineering, and it may be followed by others. The policy of large consumers of purchasing plant and equipment abroad has led to the consideration of an international cartel.

Electrical Activity.

Following upon a section dealing with coal, iron and steel and other basic industries, the survey deals with the electrical industry. The British electricity supply industry showed a record increase in output in 1927, owing partly to the recovery of ground lost in 1926 and partly to the beginning of a real recovery in production in this country. The estimated increase lay between 24 and 26 per cent., and the energy generated by statutory, non-statutory and railway companies amounted to over 10,300 million kWh. The areas showing the greatest advances were the West of Scotland, the North-East Coast and the North-East Midlands. During the first quarter of this year the upward curve of activity continued, especially in the West of Scotland, but Sheffield showed a tendency to slow down. Perhaps the most continuously active area has been the Mersey and West Lancashire; the Severn and Humber districts have shown a rapid upward movement this year. Taken as a whole the electricity supply industry is operating at a very high level of production indeed, and on the basis of this evidence alone it appears that industry is entering on a first great period of revival.

The ultra-cautious policy of supply undertakings, in view of the national reorganisation, has resulted in a shortage of plant —estimated to amount to 500,000 kW. Certain extensions of generating plant are in hand, but there is no indication of a definite programme of power plant development on the scale necessary to meet the increase in consumption. Upon the whole electricity is now being sold at an economic price, especially for industrial and domestic supplies; it may be questioned whether, in certain cases, the price is not too low. The progress of electricity supply is being affected by speculation (considered unjustifiable) based on the presumption of lower costs when generation is discontinued in favour of a supply from the Central Electricity Board. Electricity supply is entering upon a period of very great expansion and large programmes of generating plant and transmission system extensions must soon be undertaken. The orders already placed for heavy plant reflect an artificial state of affairs. Although three areas have been determined under the national scheme, there are few signs of activity in the definite allocation of orders to meet the main requirements of all these schemes. Accordingly there is a general impression that towards the end of this year there may be a glut of orders for generation, transmission, and distribution equipment which may cause complications which could be avoided with a better distribution of contracts.

Electricity production is increasing at a greater rate in this country than in the United States, Germany and Italy, while conditions in Sweden and France are not regarded as altogether satisfactory.

The British and American Electrical Industries.

Having previously compared the British and German electrical industries, the B.E.A.M.A. proceeds with a similar comparison between the British and American industries. It is claimed that the difference in output between the two countries is narrowing down owing to the higher rate of expansion in Great Britain. In 1925 the American output was valued at £319 million, which was four and a-half times that of Great Britain in 1924; in 1927 the estimated American output was £350 million, while that of Great Britain was £87 million. Although the United States market cannot be said to be "saturated," it is evident that the state of development is such as to slow down the rate of advance. On the other hand, this country is only just entering upon a first period of growth. It is shown to be difficult to gain an exact idea of the number of employés in the American electrical industry, but from estimates made it would appear to be about 375,000, against 156,508 in Great Britain. The value of output per head in the United States is almost double the British figure, but this is attributed to the immense size of the home market and the industry's ability to apply the mass-production system enabling factories to be run at a much higher load factor.

An analysis of production shows that in both countries insulated wires and cables were the largest item of production in 1924-25; 26.4 per cent. of the total in Great Britain and 11.9 per cent. in the United States. Radio apparatus (8.6 per cent. in Great Britain and 11.4 per cent. in the United States) was the second in importance in both countries. While motors (8.1 per cent.) were third in Great Britain, that place was occupied by batteries and accumulators in the United States. It is shown that even with mass production, American prices for heavy electrical plant are, on the whole, higher than British, and that the difference in costs does not wholly explain this. It is concluded that either British prices are too low or that the American product is entirely different. The increase in the value of production between 1907 and 1924 is said to have been 540 per cent. in the United States and 404 per cent. in this country. Only in two groups—generators, transformers and rotaries, and lamps—was the British expansion greater than the American. The position with regard to motors is unsatisfactory, and is said to be due to the slow rate at which industrial electrification has proceeded here.

The important positions held in the American electrical industry by the General Electric and Westinghouse Companies is emphasised, it being pointed out that although there is not such great concentration in this country, the industry cannot be regarded as inefficient from the point of view of the grouping of production. A study of generating plant and output leads to the conclusion that since 1920 the increase in American output has been about 106 per cent., as compared with 122 per cent. in Great Britain, while plant capacity has risen by 97 per cent. and 154 per cent. respectively. The American interconnected super-power systems have led to a reduction of reserve plant and a higher earning capacity per kW installed. The load factors of the generating stations have also been improved by the steady upward movement in American industrial production. In this country it is only since the beginning of 1927 that a real improvement has begun in the industrial load factor. Taking British industry as a whole, there is said to be a deficit of well over 4,000,000 h.p. to be made good before even a satisfactory state of electrification will have been reached. There is also room for expansion of industrial production generally, and in this expansion the electrical manufacturing industry should be prominent.

Electrical Exports.

In exports Great Britain more than held its own during 1927, although in the latter half there set in a lull which has since continued, owing to interruption in world demand. This may be due to the fact that the supply of equipment has temporarily overtaken demand. There are signs of a revival, however, especially in Australia, New Zealand, South Africa, certain European countries, and Japan. Canada has been consistently active, but the market is of little importance to the British electrical manufacturer. Germany's exports are moving upwards, and while it does not yet constitute a serious competitor in heavy electrical machinery, it is developing more and more rapidly its trade in small motors, small switchgear, small transformers, meters and radio apparatus. In all these directions the British manufacturer is apparently losing ground. Allowing for the fall in prices, the value of British exports can be considered very satisfactory, but there is no doubt that the competitive situation is becoming more difficult. There is a scarcity of orders leading to uneconomical price reductions which, however, shows signs of coming to an end. The prospects of the electrical exporting industry may be regarded as fairly satisfactory.

Australian Imports and Exports.

Values for 1925-26 and 1926-27 Compared.

THE following figures showing the values of the imports of electrical goods into Australia in the fiscal year 1926-27 have been taken from the recently-issued official trade returns. The corresponding figures for the previous twelve months have been added for the purposes of comparison and notes of increases or decreases are given. There is a brief reference also to Australia's electrical exports.

Imports.

	1925-26. £	1926-27. £	Inc. or dec. £
Arc lamps, except for kinematographs—			
Total	1,400	4,400	+ 3,000
From United Kingdom ...	1,000	3,800	+ 2,800
Batteries (storage) and accumulators—			
Total	329,000	867,000	+538,000
From United Kingdom ...	179,000	321,000	+142,000
,, Canada	—	10,500	+ 10,500
,, Denmark	12,400	17,500	+ 5,100
,, France	400	5,600	+ 5,200
,, Germany	2,400	8,700	+ 6,300
,, United States ...	130,000	499,000	+369,000
Cable and wire, covered with cotton—			
Total	20,000	30,000	+ 10,000
From United Kingdom ...	19,000	29,000	+ 10,000
,, United States ...	500	500	—
Other telegraph and telephone cable—			
Total	1,414,000	1,650,000	+236,000
From United Kingdom ...	1,358,000	1,562,000	+204,000
,, Holland	13,000	16,000	+ 3,000
,, United States ...	39,000	38,000	- 1,000
,, Germany	—	27,000	+ 27,000
Carbon manufactures—			
Total	27,000	35,000	+ 8,000
From United Kingdom ...	10,000	16,000	+ 6,000
,, United States ...	10,000	12,000	+ 2,000
,, Germany	4,000	3,500	- 500
Dynamo-electric machines—			
Total	1,040,000	1,041,000	+ 1,000
From United Kingdom ...	754,000	599,000	-155,000
,, Canada	8,000	11,000	+ 3,000
,, Germany	28,000	27,000	- 1,000
,, Holland	10,000	11,000	+ 1,000
,, Sweden	25,000	19,000	- 6,000
,, United States ...	186,000	339,000	+153,000
,, Switzerland ...	18,000	24,000	+ 6,000
Fans, electric—			
Total	37,000	46,000	+ 9,000
From United Kingdom ...	12,000	13,000	+ 1,000
,, Italy	10,000	14,000	+ 4,000
,, United States ...	14,000	14,500	+ 500
Switches, fuses and lightning arrestors—			
Total	302,000	415,000	+113,000
From United Kingdom ...	200,000	288,000	+ 88,000
,, Japan	200	300	+ 100
,, United States ...	93,000	112,000	+ 19,000
,, Germany	2,500	7,000	+ 4,500
Heating and cooking appliances—			
Total	53,500	86,000	+ 32,500
From United Kingdom ...	15,000	24,000	+ 9,000
,, Canada	5,250	12,000	+ 6,750
,, United States ...	31,000	43,000	+ 12,000
Lamps, filament—			
Total	484,000	615,000	+131,000
From United Kingdom ...	232,000	314,000	+ 82,000
,, Hungary	5,000	3,000	- 2,000
,, Austria	20,000	22,000	+ 2,000
,, Holland	155,000	196,000	+ 41,000
,, United States ...	47,000	50,000	+ 3,000
Measuring and recording instruments—			
Total	160,000	156,000	- 4,000
From United Kingdom ...	81,000	87,000	+ 6,000
,, Switzerland ...	24,000	15,000	- 9,000
,, United States ...	35,000	44,000	+ 9,000
,, Canada	12,000	5,500	- 6,500
Regulating and controlling apparatus—			
Total	246,000	364,000	+118,000
From United Kingdom ...	149,000	250,000	+101,000
,, United States ...	82,000	98,000	+ 16,000
,, Switzerland ...	9,000	4,000	- 5,000
,, Canada	2,000	6,000	+ 4,000
Static transformers and induction coils—			
Total	193,000	211,000	+ 18,000
From United Kingdom ...	111,000	114,000	+ 3,000
,, Sweden	27,000	10,000	- 17,000
,, United States ...	44,000	65,000	+ 21,000
Telegraph instruments and appliances—			
Total	26,000	44,000	+ 18,000
From United Kingdom ...	18,000	30,000	+ 12,000
,, United States ...	7,000	14,000	+ 7,000
Telephones—			
Total	375,000	158,000	-217,000
From United Kingdom ...	245,000	133,000	-112,000
,, Sweden	4,500	2,500	- 2,000
,, United States ...	113,500	19,000	- 94,500
,, France	7,000	—	- 7,000
,, Germany	2,500	1,300	- 1,200
Telephone switchboards and appliances—			
Total	807,000	533,000	-274,000
From United Kingdom ...	380,000	363,000	- 17,000
,, Belgium	29,000	37,000	+ 8,000
,, Sweden	23,000	5,000	- 18,000
,, United States ...	373,000	127,000	-246,000
Vacuum tubes—*			
Total	142,000	6,700	—
From United Kingdom ...	42,000	500	—
,, Holland	26,000	1,000	—
,, United States ...	65,000	5,000	—
Electrical appliances, n.e.i.—			
Total	500,000	528,000	+ 28,000
From United Kingdom ...	289,000	292,000	+ 3,000
,, Canada	7,500	9,000	+ 1,500
,, Denmark	6,500	3,000	- 3,500
,, Germany	17,000	29,000	+ 12,000
,, Japan	1,500	1,800	+ 300
,, United States ...	170,000	179,000	+ 9,000
,, Switzerland ...	300	2,000	+ 1,700
Valves for wireless telegraphy or telephony†—			
Total	—	224,000	—
From United Kingdom ...	—	86,000	—
,, Holland	—	60,000	—
,, United States ...	—	76,000	—
Wireless receiving sets†—			
Total	—	423,000	—
From United Kingdom ...	—	145,000	—
,, France	—	14,000	—
,, Germany	—	10,000	—
,, Holland	—	6,000	—
,, United States ...	..	246,000	—
Electrical insulating paper and boards—			
Total	13,500	26,500	+ 13,000
From United Kingdom ...	10,000	10,500	+ 500
,, United States ...	2,000	10,900	+ 8,900
Electrical ware of earthenware, including insulators—			
Total	46,000	51,000	+ 5,000
From United Kingdom ...	13,000	12,000	- 1,000
,, Canada	900	1,800	+ 900
,, Japan	5,000	4,000	- 1,000
,, United States ...	26,000	31,000	+ 5,000

Exports.

Australia carries on a small export trade in electrical goods of her own manufacture. Below are given the comparative values in 1925-26 and 1926-27 :—

	1925-26. £	1926-27. £	Inc. or dec. £
Electrical machinery and appliances—			
Total	21,000	74,000	+ 53,000
To New Zealand	15,000	23,000	+ 7,000
,, Fiji	750	1,000	+ 250
,, New Guinea	500	1,000	+ 500
,, India	1,000	12,000	+ 11,000
,, France	300	24,000	+ 23,700
Other electrical materials—			
Total	29,000	16,500	- 12,500
To New Zealand	23,000	15,000	- 8,000

* Valves for wireless telegraphy or telephony, which are included in this item for 1925-26, are shown separately for 1926-27.

† Not previously recorded separately.

The Lighting of a Modern Liner.

Artistic Fittings by Metro-Vick Supplies, Ltd., in the T.S.S. "Orford."

BY the courtesy of the Orient Steam Navigation Company we are able to give some brief particulars in this issue of the T.S.S. *Orford*, the latest addition to that company's fleet of well-known mail and passenger steamers, trading between London and Australia.

As a preliminary to her being placed on the regular mail service to the Dominions, the *Orford* is now engaged in making a series of short pleasure cruises in the Mediterranean, and the Norwegian fjords, for which special class of sea travel she is admirably equipped.

Fig. 1.—Well Space in the Dining Saloon.

The vessel, which has a registered tonnage of 20,000 tons, was built at the Barrow shipyard of Vickers Naval Construction Works, and is practically a sister ship to the *Orama* and the *Otranto*—both of which ships were previously constructed for the Orient Company by the same builders—and the *Oronsay*, built on the Clyde, by Messrs. John Brown & Sons, Ltd.

Fig. 2.—The Café.

An inspection of the illustrations which appear on this page, which have been reproduced from the actual photographs taken of some of the public rooms on the ship, just prior to her sailing on her maiden cruise, conveys a good general impression of the spacious and luxurious accommodation which has been provided for the comfort and enjoyment of the passengers, but, to thoroughly appreciate the high standard of elegance and refinement which has been attained in the classic design and rich colourings included in the decoration and furnishings of these stately rooms, it is really necessary to make a personal inspection of the ship.

Fig. 1 is a view of the well space in the dining saloon, the classic scheme of decoration being completed by the handsome central fitting with a crystal base and glass panels held by ornamental metalwork. To the right is seen the main dining saloon, which is shown in fig. 4. Here there are a number of shallower glass-panelled bowls with simple ornamentation fitting closely into the general arrangement of the apartment.

A view of the lounge appears in fig. 3. Here the main illumination is provided by octagonal panelled fittings with a cut-glass base and an upper four-panel lantern. The lighting of the café (fig. 2) is carried out with cubical ceiling fittings of simple design but of very handsome appearance.

The fittings for the lighting of the public rooms were provided by Metro-Vick Supplies, Ltd.; they were produced at the company's fittings factory—Harcourts, Ltd., Birmingham. It is claimed that the fittings represent a departure from the type usually associated with ship lighting, including, as they do, several new and important features in design and construction, which were suggested by the architect to the Orient Company, Mr. A. N. Prentice, F.R.I.B.A., whose artistic designs in the decoration and furnishing of the public rooms may confidently be expected to firmly establish the reputation of the *Orford* as being one of the favourite and most popular ships in the passenger service to Australia. Metro-Vick Supplies, Ltd., also supplied the lighting fittings of a more standard nature for the other parts of the ship.

Fig. 3.—The Lounge.

Fig. 4.—Main Dining Saloon.

A Special Lighting Installation.

Some Notes on the Electric Lighting Equipment at the New Madame Tussaud's.

THE new Madame Tussaud's, which houses a kinema, restaurant and waxworks exhibition, contains a number of unique lighting units, most of which were specially designed by the Fittings and Fixtures Department of the GENERAL ELECTRIC CO., LTD.

The main ceiling pendants in the kinema auditorium, fig. 1, each of which is equipped with gasfilled lamps aggregating 1,200 W, are of gilt-metal finish with special "Sunshine" amber-toned glass panels. This lighting is augmented by concealed trough lighting around the base of the lofty dome, which is 30 ft. in diameter, fig. 3, and gilt-finished amber glass-panelled pendants installed over the balcony. The back gangway of the gallery is illuminated by flush ceiling fittings, each housing 60-W lamps, while the under-gallery is illuminated by lay lights.

The kinema entrance hall is illuminated by pendant fittings of similar design to those installed in the balcony, each being

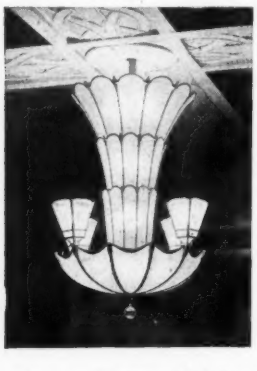


Fig. 1.—Kinema-Lighting Units.

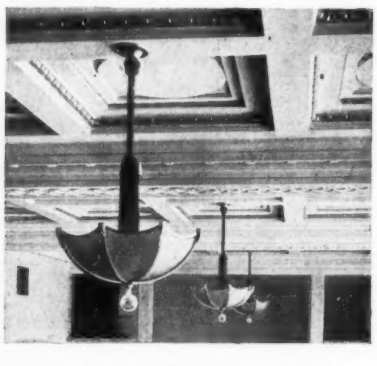


Fig. 2.—Kinema Entrance "Sunshine" Fittings.

panelled with a special form of "Sunshine" glassware, harmonising with the rest of the fittings, fig. 2. Each unit is equipped with eight 40-W lamps. A large number of Demi-Coupe-type wall brackets matching the pendant fittings are also installed in this part of the building. The tea room lighting is contrived by a number of beautifully designed pendants fashioned in gilt metal work and glazed with a special form of delicately tinted rose-coloured glassware with wall brackets to match.

Large numbers of lamps of all kinds used throughout include daylight-blue lamps for the effect lighting of many of the tableaux in the exhibition halls; these lamps are also used for

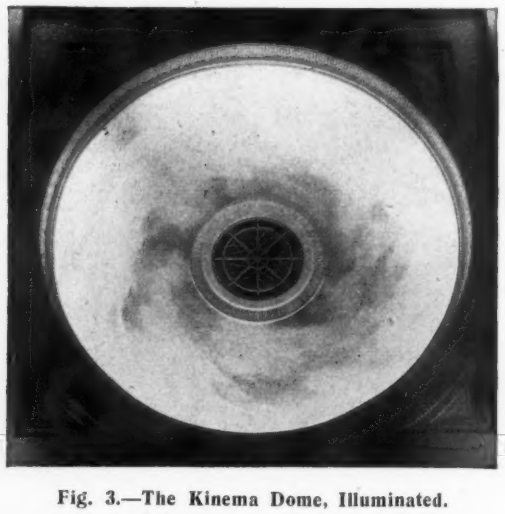


Fig. 3.—The Kinema Dome, Illuminated.

the three large exterior signs, while Pearl Osram lamps are used for the canopy lighting over the entrance halls.

In the kinema there is installed G.E.C. stage-lighting equipment which consists of a main footlight, an orchestra footlight mounted on the orchestra lift platform, proscenium strip lighting, a set of battens with silvered glass reflectors giving maximum reflected lighting efficiency, and wing floods. A set of spot-lights of the arc- and gasfilled-lamp types are also provided, as well as two new 100-A model front-of-house arc-lamp projectors fitted with iris diaphragms mounted on heavy-type ball-bearing swivelling pedestal stands.

The restaurant, which is situated between the kinema and the exhibition halls, is illuminated by a number of handsome modern type pendant fittings, each of which measures over 7 ft. in length. The metal work is fashioned in real bronze colour and fitted with a special form of diffusing glassware incorporating graduated tinting, ranging from amber to pearl. These fittings, which are supported by old-gold silk rope suspensions and equipped each with seven 100-W lamps, give a very pleasing lighting effect. The wall brackets are also very tastefully designed and have a background of pearl finish, with illuminated panels of different tones to match the main pendant fittings.

The illumination of the chocolate lounge is effected by semi-indirect lighting pendants with satin-finished slightly-amber-tinted glassware. The metal work is in real bronze colour and fawn silk suspension is employed. The light sources in each pendant are five 100-W lamps. Similar lighting also obtains in the "Jungle."

Mention must also be made of the pleasing form of lighting which obtains in the restaurant vestibule, and particularly of the beautifully fashioned main lighting unit. This is designed on very graceful lines, with metal work of real bronze colour and a special form of satin-finished glassware. Supplementary lighting consists of one-light brackets arranged in the form of small lanterns to match the main unit.

Excellent as is the illumination of the kinema and restaurant, it is nevertheless eclipsed in the exhibition halls. Here specially designed indirect lighting units are installed for meeting the peculiar needs for illuminating the various tableaux and figures. These units harmonise with the architectural features, and, as they are made of Carton Pierre and finished to the colour and tone of the frieze, the solid mass appearance associated with so many forms of indirect lighting is in this instance absent. Each unit has fawn silk-rope suspension and houses five 100-W gasfilled lamps. Each setting, according to its character, has been treated by special-effect lighting, excellent examples of which are those provided for the "Royal Tableau," fig. 4, in the Grand Hall, and "The Signing of Magna Charta by King John."

The Chamber of Horrors enjoys lighting quite in keeping with its gruesome relics and occupants. This is carried out by means of a number of lanterns of antique design modelled on lines appropriate to their weird surroundings.

The new lighting wonders of this world-famous institution show that no subject is outside the pale of the illuminating engineer's art, and Messrs. John T. and Bernard Tussaud deserve well for having called for such uncommon lighting requirements for their exhibition.

The consulting engineers responsible for the installation are Messrs. Albion T. Snell & Partners, while the electrical contracting firm responsible for the installation work is the Berkeley Electrical Engineering Co., Ltd.

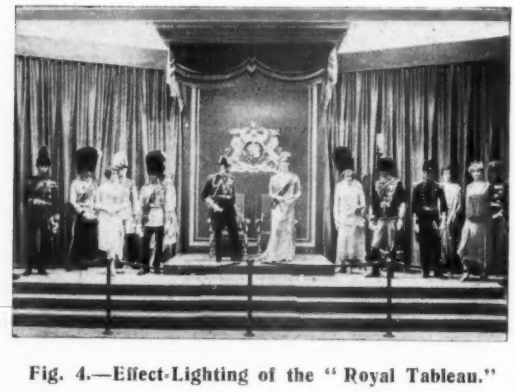


Fig. 4.—Effect-Lighting of the "Royal Tableau."

A sub-station of the Marylebone electricity undertaking is situated below the premises and gives a 3-phase, 4-wire, a.c. supply and a 3-wire d.c. supply for the motors. Two 65-kW G.E.C. motor-generator sets are installed for the general lighting supply, together with the necessary switchboard and control gear.

Transmission Line Power-Arcs.

The practical results of a series of power-arc tests carried out by the Shawinigan Water and Power Company.

By PAUL ACKERMAN, A.M.E.I.C.

(*Abstract of Paper read before the* ENGINEERING INSTITUTE OF CANADA.)

IN connection with relay protective work, it is essential that the properties and behaviour of the power arc be known. In order to acquire this knowledge, the Shawinigan Water and Power Company has carried out a series of power-arc tests with simultaneous oscillographic and moving-picture records. The tests were to cover the following points:—

(1) Arc voltage in relation to arc current, to determine the sensitiveness of directional relays required.

(2) Power-arc damage in relation to current and time, to establish the importance of quick clearance of arcs so as to avoid permanent damage.

(3) Spreading of the arc in relation to time, to show the importance of quick clearance of arcs to avoid spreading of the arc into other phases or adjacent circuits.

The tests extended over a current range of approximately 100 to 10,000 amperes, and included arcs over pin insulators of representative voltages from 2,200 to 60,000 volts, suspension insulators for 110 kV, and arcs across line conductors.

General Characteristics of a Power-Arc.

Lightning flashing over an insulator causes a fine filament of air to heat up to arc temperature. The resistance of this air path is thus lowered and offers a ready path to the power current of the system itself. The heat produced in the puncture path is enormous, and as a result thereof the hot air will explode to a larger diameter and thus form the large arc known as a power-arc. The same condition will be created when wires get within striking distance of one another, the voltage puncturing the air and creating a low-resistance path for the power current.

The power-arc, when expanding, will lower the ohmic resistance of the arc, and in consequence the ohmic heat generated within will drop. On the other hand, the heat radiation from the arc surface will increase because of the increasing arc surface. The arc will therefore expand until the dropping ohmic heat generated in the arc will strike a balance with the increasing heat radiated from the arc surface.

The theory of the power-arc shows that the physical dimensions and the voltage of the arc directly depend on the arc current. The tests have brought out the following chief features of the power-arc:—

(1) *The initial explosive expansion* of the puncture path to the final dimensions of the power-arc takes place within approximately 1/1,000 of a second.

For the tests the puncture path was represented by a No. 34 copper wire of a diameter of 0.006 inch. The arc diameter was in most cases between 2 and 3 feet. In other words, the arc exploded within 1/1,000 second to a diameter about 5,000 times its original size.

(2) *The specific resistance* of the arc vapour is approximately 14 ohms per cubic inch, compared with 7 by 10^{-7} ohms per cubic inch for copper. This means that the specific resistance of the arc vapour is approximately 20,000,000 times greater than the specific resistance of copper.

(3) *The power in the arc* in its initial stage ranges anywhere from 50 to 3,600 kW for 600- to 1,200-ampere arcs, and from 3,000 to 15,000 kW for 10,000-ampere arcs.

(4) *The radiating constant*, that is, the power radiated from the arc surface, seems to vary largely in different tests. Most of the values range from 150 to 350 watts per square inch arc surface for currents below 1,500 amperes, whereas for 10,000-ampere arcs the constant varies between 2,000 and 4,300 watts per square inch. It is suspected that the large variation is largely apparent only.

It appears reasonable to consider 300 watts per square inch an average value for all practical short-circuit currents up to several thousand amperes. How far this value may be increased by prevailing winds is uncertain.

(5) *The arc diameter* of the initial arc increases only slightly with the current.

It is important to note that the power-arcs for 600 to 1,200 amperes are always about 2 to 3 feet in diameter, irrespective of the size or type of insulator. Arcs for 10,000 amperes increase in diameter to 4 or 5 feet.

(6) *The arc voltage* for long-stretched arcs changes very little with a change in current, its tendency being downwards with increasing current. The arc voltage, however, is directly proportional to the arc length, which indicates that the voltage will increase with the spreading of the arc.

Test results indicate the interesting fact that for a range of current from 70 to 10,000 amperes the voltage for the initial arc is about the same for the same type of insulator, or the same length of arc. The average values for the various types of insulators and conductor spacings were found to be approximately the following:—

7-disk suspension insulator	1,200 volts
60-kV pin insulator	900 ,,
27-kV pin insulator	500 ,,
2.2-kV pin insulator	250 ,,
Conductors:	
18-inch spacing	600 ,,
60-inch spacing	1,900 ,,
96-inch spacing	2,800 ,,

The arc voltage is thus chiefly dependent on the arc length. An arc between widely-spaced conductors may develop a very long-stretched arc with the result of the arc voltage increasing proportionally. In some of the tests, by its natural chimney effect, the arc rose in about three-quarters of a second to a height of 30 feet or more, corresponding to an approximate arc length of 60 feet, the voltage in this case exceeding 20,000 volts. For practical purposes, it may be assumed that the arc voltage will be approximately 400 volts per foot length of arc, irrespective of the short-circuit current.

Practical Conclusions.

The tests show clearly that the duration of the arc is more serious and more damaging than the current magnitude. The arc has an excessively high temperature, probably in excess of 3,000 deg. C. As a result, wherever the arc clings to the insulating material or the conductor, damage must result if this condition prevails for any length of time, irrespective of the current magnitude. If the arc, on the other hand, is cleared instantaneously, then only the very surface of the insulating material or the conductor is touched and no damage will result if the arc is quenched before the heat has time to penetrate. Complete immunity to damage from a power-arc could be expected if the arc was cleared within one-tenth to two-tenths of a second. Under this condition, full control of the situation would be obtained. With present-type oil breakers, such quick clearance cannot be obtained. The quickest arc clearance to be expected with so-called instantaneous protection is approximately one-half second or slightly less. Even with this time delay, the damage is usually found to be comparatively small. With power-arcs in excess of one-half second duration the extent of damage is entirely dependent on circumstances.

In cases of arcs between conductors, wind at right angle to the transmission line will be most serious and may result in burning-off the conductors or seriously damaging them. With the wind in the direction of the line or at a small angle to the line, the arc will travel along the conductors and thus avoid serious damage at any one point, causing simply a pitting of the surface of the conductor, depending on how nearly stationary the arc is.

In the case of suspension insulators, the power-arc damage is usually confined to the top and bottom units. The disks between are shielded until the end units are broken up. This takes place in a fraction of a second. Wind in the direction of the transmission line also tends to carry the arc away from the insulator along the conductor and up into the supporting structure, thus completely protecting the insulator. Wind at right angles to the transmission line may affect the bottom skirts, whereas the top unit again is likely to be protected by the arc passing off into the structure. Arc horns and arc rings help to deflect the arc, and thus tend to protect the end units.

With quick clearance of arcs, suspension insulators are quite safe from serious power-arc damage, even without protecting arc horns or rings. This is borne out by practical experience, which indicates that with instantaneous line protection hardly ever are any insulators found damaged from lightning flashovers, or if such damage occurs it is confined to a slight chipping of the bottom unit without affecting the insulation of the line.

Pin-type insulators are more sensitive to power-arc damage because of the hot gases being caught underneath the bottom skirt and breaking them, even when arcs are cleared within one-half second. Power-arc damage in the case of pin-type insulators is particularly serious because of the smaller safety factor of the pin-type insulator by the nature of its construction, consisting as a rule of only two or three skirts. Thus, with two of the skirts broken up, the flash-over value of the insulator may be greatly reduced. With pin-type insulators, there exists also a great danger of burning-off the tie wires, thus leaving a mechanical weakness which may later on result in the cable falling off the insulator. The tests, however, indicate that with instantaneous clearance there is a fair chance of pin-type insulators escaping without per-

manent damage under most conditions. This is verified by actual experience on transmission lines, where lightning flash-overs hardly ever permanently disable a line.

The tests clearly indicate that it cannot be sufficiently emphasised that everything possible must be done to reduce the duration of a power-arc if full control over power-arc damage is to be obtained. It is not sufficient to provide instantaneous relays; it is necessary also that the switch manufacturer shall do everything possible to speed up the operation of the oil circuit-breakers.

Explosive Expansion of the Arc.

The tests indicate that the initial explosive expansion of the arc after the air has been punctured assumes within 1/1,000 of a second or less a very large diameter. This diameter will be 2 to 3 feet for currents of a magnitude of 600 to 1,200 amperes, whereas with 10,000 amperes the diameter may extend to 4 to 5 feet.

It is evident that with a small separation of conductors between phases or circuits, such as is customary on low-voltage lines, the arc will spread into adjacent phases or lines almost instantaneously. Nothing can be done to prevent this, except isolated phase construction, so far as station work is concerned. On transmission lines the separation of phases, to avoid such spreading of the arc into adjacent phases, would have to be made far too great to warrant it for economic reasons. With quick clearance of the arc, however, no harm should be experienced from such arcs.

In the case of higher-voltage systems, the currents are usually less than 4,000 amperes, so that the initial arc should not exceed 3 to 4 feet diameter, whereas the separation of phases is usually larger. With quick clearance, therefore, there should be no danger in this case of the initial arc reaching into other phases.

Arcs discharged in a wooden box indicate that the high pressure forms in the arc before the arc is completely exploded. Two 4-foot long boxes, of 9 by 9 inches and 12 by 12 inches cross-section, through which 10,000-ampere arcs were discharged, exploded completely, blowing the sides 10 or 20 feet away. If it is assumed that the law of gas compression applies to the arc vapours, then the arc pressure within the 9- by 9-inch box before its explosion would be about twenty-eight times greater than atmospheric pressure. This explains readily the reason of switch cell doors or loose phase partitions being found blown off after local short-circuits.

A blackening of the inside walls of the wooden boxes is only on the surface of the wood, there having been no tendency to ignite whatsoever. This indicates how even inflammable material is immune to ignition from power-arcs if the arc is extinguished instantly. This observation is verified by the practical experience of switch bushings, with a compound surface, flashing over and being cleared instantly. The only harm done to such bushings was a very slight surface charring which could be easily scraped off.

Chimney Effect of Arc.

Hot air has the tendency to rise, so that the arcs will tend to spread upwards. The tests were conducted on still days, so that whatever spreading of the arc was observed was chiefly due to the natural chimney effect of the arc.

The spreading of the arc, in the case of insulator flashovers, is rather limited and the arc retains a compact form. Arcs between conductors have a tendency to rise to considerable heights.

The tests clearly indicate that only quick-acting protection will be able to prevent the spreading of power-arcs into other phases or other wires located above.

It is often customary to string low-voltage circuits on the same pole line above each other. The tests indicate that in such cases it is not impossible for the arc to rise into the upper circuits, with the result that different circuits will be involved simultaneously.

In the case of high-voltage lines, it is very essential that ground faults be cleared as such without developing into phase short-circuits, to keep down the disturbing effect on the whole system. Therefore, an arc on lower phases must be cleared quickly if it is to be prevented from rising into upper phases.

In order to avoid arcs blowing into other circuits, the lay-out of switching stations should be such that the least number of crossings of apparatus leads are provided, and that where such crossings are unavoidable effective separation is provided, irrespective of the operating voltage, unless instantaneous zone protection is provided. This point should be particularly observed in all those cases where polyphase short-circuits are disastrous to the synchronous stability of the system.

Wind Effect on the Arc.

The arc is very susceptible to air currents; it will always spread very readily in the direction of the wind. It is comparatively easy for a power-arc to be blown into an adjacent line 20 feet away with a heavy gale blowing at right-angles to the line. This indicates that if full control of this condition is to be obtained, it will be necessary to extinguish the arc within a small fraction of a second.

It may be stated, therefore, that even with the quickest clearance of arcs it will not be possible fully to prevent arcs from spreading into other phases or other lines, but it will be possible at least to reduce such hazards to an absolute minimum.

Persistency of Power-Arcs.

In an appendix a theory has been developed for the possible self-extinction of power-arcs. There is a certain fixed relation between arc voltage, arc current and arc length, which, if disturbed, will result in the extinction of the arc. It was found that for currents between 100 and 10,000 amperes the critical relation of voltage and arc length is approximately 400 volts per foot of arc length. In other words, if the voltage is less than 400 volts per one foot of arc length, an unstable condition is created which will result in the complete extinction of the arc.

This comparatively low voltage required to maintain an arc explains the persistency of a power-arc. It means, for example, that with 60,000 volts across an arc the arc is able to expand to 150 feet without danger of rupture, provided the system is able to supply the current without pulling down the voltage.

Cutting-out Line Sections under Voltage.

In this case, the capacity current is to be interrupted; it may readily amount to a few amperes.

With good air-break switches, this method of disconnecting a line section may be satisfactory under good weather conditions where the arc can rise vertically and finally exceed the critical arc length. With wind, the arc may, however, be blown into adjacent phases, developing into grounds or short-circuits.

Rupturing the Magnetising Current of a Transformer Bank.

On smaller transformer banks at high voltages, the current may readily be less than one ampere, so that the critical arc length may be within the possible scope of an air-break switch It will be appreciated, however, that as soon as the bank capacity gets larger, with correspondingly higher magnetising current, the arc will be more persistent, and, depending on the wind, a limit will be reached in the safe handling and rupturing of the magnetising current.

[Several appendices, dealing with the theory of the subject, follow the paper, which was published in the *Engineering Journal* for May (the official journal of the Institute).—Eds. Elec. Rev.]

Central England Electricity Scheme, 1928.

The Revised Version Adopted by the Central Electricity Board.

THE revised scheme for Central England, which has been adopted and published* by the Central Electricity Board, differs little from the general specification of the original scheme† that was prepared by the Electricity Commission in pursuance of Section 4 of the Electricity (Supply) Act, 1926.

The principal modifications are the listing (Part I, second appendix) of the Hylton Road generating station of the Worcester Corporation as fully selected instead of "temporary" plant; and the omission (Part II, second appendix) of extensions and alterations contemplated at the undermentioned selected stations: Hams Hall (Birmingham Corporation), Hardingstone (Northampton Electric Light & Power Co., Ltd.) North Wilford (Nottingham Corporation), Spondon (Derbyshire and Nottinghamshire Electric Power Co.), Stourport (Shropshire, Worcestershire and Staffordshire Electric Power Co.). This change does not mean that the expected programme of development will not materialise, but merely that it will take place as and when required, instead of being restricted by a specified time table.

Similarly, all dates of completion of main and secondary transmission lines have been deleted (Parts I and II (1), third appendix); the 132-kV lines otherwise remain virtually unaltered, except for the addition of a short connecting link between the Nechells and Nechells (Princes) stations. The kVA capacities of all transforming stations (Parts I and II (2), third appendix) have, however, been deleted. Two secondary 33-kV transmission lines between Warwick and Stratford-on-Avon and between Banbury and Shipston-on-Stour, have been left out of the revised scheme, together with consequential transforming stations, because whenever it seems likely that such lines will be provided by other authorities than the Central Board the latter stands aside.

Three "national grid" schemes (for Central Scotland, South-East England, and Central England, with an independent Company scheme for East Anglia), have been adopted by the Central Board. It is understood that the next one to be prepared by the Commissioners will be for North Wales with parts of Lancashire, Westmorland and Cumberland; whilst the four remaining to be framed will be for Lancashire, Yorkshire, South Wales with South-West England, North-East England with South-East Scotland, and a subsidiary one for Scotland: thus totalling eight schemes and one subsidiary one.

* H.M. Stationery Office, price 1s. 6d. net.

† Elec. Rev., March 23rd, 1928, p. 529.

The Institution of Civil Engineers.—I.

Celebration of Charter Centenary, and Engineering Conference.

THE celebration of the Centenary of Incorporation by Royal Charter of the Institution of Civil Engineers has been held during the week, the first ceremony being a special service at Westminster Abbey on Sunday, followed by a reception of delegates and an address by the President (Mr. E. F. C. Trench) in the Great Hall of the Institution in Great George Street on Monday morning, June 4th. Before proceeding with the business of the gathering, it was decided to send a loyal address to his Majesty the King on the occasion of his birthday, in which reference was made to the great interest always taken by his Majesty and the members of the Royal House in those works which it is the privilege of engineers to carry out, and on which the welfare, prosperity, and safety of the Empire depend.

The President then gave a welcome to the delegates, who numbered over 200, and represented 97 engineering and scientific institutions and societies and universities at home, in the Dominions, and in all the principal countries abroad.

Addressing the delegates, the President gave a comprehensive account of the inception and development of the Institution of Civil Engineers, and pointed out that the eight original engineers who founded the Institution deserved to have their names remembered for all time. They might not all have been great engineers, but they laid the foundations not only of the Institution but of all the daughter institutions in this country and in the Empire beyond the seas. They were James Ashwell, Charles Collinge, Joshua Field, James Jones, John Thomas Lethbridge, Thomas Maudslay, William Maudslay, and Henry Robinson Palmer. The first meeting took place at the Kendal Coffee House in Fleet Street on January 2nd, 1818, and the first Charter was granted on June 3rd, 1828. It was not a little remarkable, said the President, that at that early date it should have been possible to find a form of words so adequate and so comprehensive to describe the work of the civil engineer, and that those words should, in spite of all developments and discoveries of science, be still a complete description of the work of the profession of civil engineering, *viz.*, "the art of directing the great sources of power in Nature for the use and convenience of man." The Institution was not intended to be, nor was it, a sectional society—it was wide enough in its constitution to embrace all branches of the engineering profession, except military engineering.

A hundred years ago the members numbered 156, but at the date of the last annual general meeting the membership was 10,210.

After referring in general terms to the work of the Institution and qualifications for membership, the President said that the success of the Institution and the advantages derived from membership had had the natural result of encouraging the formation of other engineering societies. These were now very numerous; some had their headquarters in London, some in the large provincial centres, and some in distant parts of the Empire. The Institution recognised that with the vast expansion of engineering work it was impossible for one Institution to give to every branch of the profession all those opportunities for friendly intercourse and for the intimate discussion of the details of its own professional work which were so valuable and necessary. All were helping to spread the light of engineering knowledge, and in this good work the Institution of Civil Engineers desired heartily to co-operate. This attitude did not, in the opinion of the Council, involve any departure from, nor was it desired in any way to depart from, the position adopted by the founders of the Institution and formulated in its Charter.

The question of legal regulation of the civil engineering profession was one of considerable difficulty and complexity, discussion of which was not infrequently clouded by assumptions of complete analogy between the engineering profession and professions whose members were brought into more intimate personal contact with individual members of the general public in the ordinary exercise of their professional duties. Whatever developments in this respect might take place, it seemed clear that they could be awaited with equanimity by a body of engineers which was constantly doing its utmost to ensure the highest possible qualifications on the part of its members. It was also clear that persons who possessed such qualifications had a *prima facie* title to be regarded as the most suitable source from which to draw, at all events, those engineers who were responsible for the expenditure of public money on engineering work. The Institution had taken steps from time to time to bring this consideration before the notice of the proper authorities. Its representations had, in general, been sympathetically received, and its views on this question were being accepted and acted upon.

The remainder of the function was devoted to the presentation of addresses of congratulation and goodwill by the delegates, but owing to the larger number, it was decided to have only a few of them read. Actually nine were read, and they were mostly short. Among them were the addresses of the Institution of Electrical Engineers, presented by Mr. A. Page (president) and Dr. W. H. Eccles, F.R.S. (past-president), the Royal Society, and the Institution of Mechanical Engineers.

A cordial vote of thanks to the delegates, proposed by Sir Alexander Kennedy, brought the meeting to a close.

In the afternoon the "James Forrest Lecture" was delivered by Sir Alfred Ewing, K.C.B., D.Sc., F.R.S., extracts from which are given below. The three following days were devoted to the Engineering Conference, visits to works, and social functions.

A Century of Inventions.

(*Extracts from the* JAMES FORREST LECTURE.)

By SIR J. A. EWING, K.C.B.

The Council, when inviting this address, suggested a very comprehensive text, namely, a prediction which Thomas Tredgold added to the definition of Civil Engineering which he drew up for the petition for a Royal Charter presented in 1828. It ran thus:—

"The scope and utility of Civil Engineering will be increased with every discovery in philosophy, and its resources with every invention in mechanical or chemical science."

Seldom, surely, has a prophecy been so justified in the event. The history of engineering during the century which has passed since these words were written is in its main features the story of their fulfilment. Every advance in scientific theory has increased the engineer's mastery of the material world. Discoveries, which at first may have seemed wholly unserviceable to him, have in fact furnished new points of departure, leading in ways that were often unforeseen to enlargements of his many-sided art.

Nowadays theory and practice march together in such close association that it is often difficult to distinguish them as separate figures in the procession. From modest beginnings physical science and engineering have advanced, side by side, and in the advance their intimacy has developed; they have discovered the advantages of relationship and the relationship has itself become closer.

In this review we have to go back further than the reach of even the longest individual memory. Try to realise what engineering meant in 1828, what was its relation to the science of the day, and what in fact was, in that day, the state of science! When one looks into the technical literature of that period one is sorry for the early student of engineering. Physicists and engineers alike were groping their way, confusedly, towards mechanical ideas which were as strange then as they are familiar now. Prejudice against the calculus remained for long a serious handicap to the British student of engineering. Teachers misspent their ingenuity in dodging the calculus; they often led the student to think of it as mysterious and unattainable when he ought to have been learning not how to avoid, but how to use what is really an indispensable intellectual tool. The bogey is now pretty well laid, thanks in great part to the unconventional yet effective teaching of the late Professor John Perry.

Not less than mechanics and heat, the science of electricity was still in its infancy. Ohm's Law had been formulated in 1825, but in the absence of units and instruments of measurement its significance could not be understood. It was not till the requirements of the telegraph had to be met that the engineers and physicists together attacked the problem of framing a logical system of electrical units, determined their magnitude, set up standards, and established practical means of comparing electrical quantities with them. The work was begun in the early 'sixties, under the auspices of a Committee of the British Association, of which the secretaries were Clerk Maxwell the physicist, and Fleeming Jenkin the engineer. What it accomplished was an incalculable boon to the investigator in pure science no less than to the technician.

To be able to *measure*—that, as Lord Kelvin used to say, is in any subject the first step towards real scientific knowledge. Not in electricity only, but in mechanics, in heat, in all the properties and actions of matter where engineers and physicists find common ground, it is through the alliance between science and practice that the art of measurement has been evolved. And all through the century now under review we see the same alliance at work, with the same give and take of advantage. Our knowledge of physical constants and of the properties of materials, our units and scales and instruments and testers of all sorts, are for the most part offspring of the marriage of science with practice. They make science exact, and they allow engineering to be standardised.

It is to aid engineering no less than pure science that we now supplement private enterprise by the official organisation of research. In this it must be admitted that we followed somewhat slowly the example set by Continental neighbours. The

National Physical Laboratory was promoted by the joint efforts of physicists and engineers. In the hands of Sir Richard Glazebrook the value of the laboratory was so fully demonstrated that after a time, from being semi-official, it was made official—becoming a truly national laboratory, administered by a new Government office, the Department of Scientific and Industrial Research. That department, established in 1916, remains with us as a beneficent legacy of the war, which turned men's thoughts, as never before, to mechanical problems. Research, and the adaptations of research, from being treated with general indifference, were hailed as a way to public salvation—salvation not only from the immediate menace of the struggle itself, but (after that was past) salvation from the abiding danger of international competition and the burden to industry through waste and debt. The national intelligence was stirred; blind eyes were opened. They have remained open, and the Department does much to keep them open. One had to preach, insistently, to the followers of an older rule-of-thumb that time spent in scientific study was not time wasted. All that is changed now. From the big establishments representatives come beforehand to learn the names and qualifications of youngsters who are about to take their degree. The most promising are snapped up; all seem to find ready employment; they are paid for their work instead of paying a premium for the privilege of entry—though in truth they have much to learn of a kind no college can teach. This, surely, is evidence that engineers recognise, more and more, the benefit of associating practice with science.

In the region of applied electricity, perhaps more than in any other part of engineering, instances multiply themselves of the exchange of benefits between practice and science. One may say, with perfect truth, that all the applications of electricity are in their origin fruits of scientific research. And may it not be fairly claimed that all the practical devices of electrical engineers have advanced the purely philosophic study of electricity?

Towards the end of last century, when physical science seemed to some of its votaries to have settled into a groove, suddenly there was an astounding outburst of discovery. The X-rays, radioactivity, the electron—these followed one another in bewildering succession; discoveries wholly unexpected and pregnant with uses to mankind. Each in turn was a revelation to the philosopher; it gave a fresh direction to his concepts of Nature, and it enriched him with novel methods of research. Each of these discoveries also offered an untrodden avenue of practical application. At the moment the very basis of physics is in a state of flux. Its exponents are struggling to assimilate two momentous new ideas—the principle of relativity and the quantum theory. The relation of these ideas to the familiar body of older physics is obscure. One may say that, while the superstructure remains intact, the philosophical foundation on which it stands is strangely disturbed. Physicists have to transfer bodily their elaborate and beautifully coherent building, as a going concern, from one foundation to another, and the new foundation is not quite ready. They are hard at work laying it, laying it indeed so deep that the passer-by cannot make out what is going on. When the operation is completed it will be a great achievement. But I do not think it will make much difference to the engineer, for his concern is with the superstructure itself. That will doubtless settle down quite comfortably when the necessary adjustments are made. It will function as well as before, and continue to admit of extensions which the engineers will in due time turn to practical account.

The century we now review is but a petty unit in the multitude of centuries that make up the recorded and unrecorded history of man. By comparison it is a mere fragment of time, yet how big when judged by the changes it has wrought! If you test progress by the conquest of inanimate nature, the century now closing finds no parallel in the past. It may be likened to the efflorescence of a plant which for long has been quietly growing to maturity and suddenly bursts into flower. Can we expect the engineers of the coming century to bring about developments in the application of natural resources comparable to those of the past hundred years? To me it seems more likely that there will be something of a lull in the revolutionary fervour of the engineer. Social changes—drastic social changes—may be looked for, but not, I think, so directly consequent on his activities as in the century now ending. It may very well happen that the mental energy of mankind, now flowing so strongly in this channel of ours, will seek and find outlets in other directions. While as engineers we may regret such an issue, we cannot but admit that it may prove beneficial to the human race, since, beyond question, there is grave need for progress of quite a different kind. For the fact remains that all our efforts to apply the sources of power in Nature to the use and convenience of man, successful as they are in creating for him new capacities, new comforts, new habits, leave him at bottom much what he was before. Collective moral sense, collective political responsibility, the divine maxim to do to others as we would that they should do to us—these are lessons in respect of which all the nations, even the most progressive, have still much to learn.

There are people who talk glibly of the next great war. I wonder if they know how near, in the last war, the world came to destruction through misapplying the endowment which it owes to the engineer. Do they realise that with added experience and further malignant ingenuity, the weapons of a future war will be more than ever deadly, more than ever indiscriminate, and the peril to civilisation will be indefinitely increased?

Surely it is for the engineer as much as any man to pray for a spiritual awakening, to strive after such a growth of sanity as will prevent the gross misuse of his good gifts. For it is the engineer who, in the course of his labours to promote the comfort and convenience of man, has put into man's unchecked and careless hand a monstrous potentiality of ruin.

Turbo-Electric *v.* Diesel Drive for Large Passenger Ships.

IN a contribution to our contemporary *Shipbuilding and Shipping Record* Dr. W. L. R. Emmet, of the American General Electric Co., gives some very instructive figures as to the cost of operation of a large passenger ship equipped with the turbo-electric drive and a similar vessel driven by direct-coupled Diesel engines, a comparison which is considerably in favour of the former. The vessels in question are the new liner *California*, of 30,250 tons displacement, propelled by steam turbines direct coupled to electrical generators which in turn supply current to the propelling motors which give the vessel a maximum speed of 18 knots, and the Swedish-American liner *Gripsholm* of 23,600 tons displacement having two double-acting four-stroke cycle Diesel engines giving her a speed of 16 knots. The *California* burns fuel oil in the boilers for steam raising while the *Gripsholm*, of course, uses the rather more expensive Diesel oil, and in order to obtain a fair basis of comparison, Dr. Emmet bases his figures upon a speed for both ships of 16 knots, which is unfavourable to the *California* since she must use two generating units lightly loaded at a speed above about 15.5 knots. At 16 knots, the fuel consumption per day of the *Gripsholm* is 61 tons of fuel oil and 1 ton of lubricating oil which, since lubricating oil costs eight times as much as fuel oil, may be considered as equivalent to 69 tons of fuel oil. The *California* uses 106 tons of fuel and no appreciable quantity of lubricating oil. These consumptions are for all purposes, and since the *California* cooks by electricity and refrigerates a large cargo of fruit for two-thirds of her round trip, the all-purpose comparison is in no way favourable to her. Using these figures, the fuel consumptions are:—

California	0.0211 lb. per ton-mile.
Gripsholm	0.01715 lb. per ton-mile.

Considering now the question of fuel cost, a company operating many Diesel ships and steamers in a very recent large contract paid at New York for Diesel oil $15 (61.5s.) per ton and for oil burned in steamers $10.20 (41.8s.) per ton. The fuel costs per 1,000 ton-miles are therefore: *California*, $0.096 (0.394s.) and *Gripsholm* $0.1145 (0.47s.). The *Gripsholm* is, however, given credit for being the smaller vessel since the larger ship drives more easily per ton and this correction brings the comparison to *California* $0.096 (0.394s.) and *Gripsholm* $0.106 (0.435s.) oil cost per 1,000 ton-miles. The difference in cost of machinery between the *Gripsholm* and a similar ship with turbo-electric drive is not known, but on the basis of comparison of Diesel and geared turbine ships given by Sir John H. Biles in *Engineering*, June, 1926, it would be about $250,000 (£51,200) in favour of the turbo-electric ship. The value of this saving, if considered on a 10 per cent. basis, is equivalent to about 10 per cent. of the annual fuel bill. There would also be an appreciable saving of weight.

A liner somewhat similar to the *California*, which is being built for the International Mercantile Marine Co., has a steam pressure 75 lb. per sq. in. higher and 150 deg. F. more superheat and with equally good turbines her propulsion should be 10 per cent. more efficient than that of the *California*. Thus, the above just comparisons show that on this fuel price basis, a good turbo-electric ship might have advantages equivalent to a fuel saving of about 28 per cent. as compared with a similar Diesel ship. Dr. Emmet then enumerates certain other advantages of the electric drive which we have frequently discussed in our columns but which cannot be estimated in terms of dollars or sterling, and he also mentions the possibility often referred to by advocates of the Diesel engine that almost any type of liquid fuel can be burned. With regard to the latter point, he refers to the undoubted fact that the majority of Diesel ships prefer to burn the more expensive fuel and that higher prices than the $15 per ton quoted above have been paid in New York for high-grade Diesel oil.

In conclusion, he states that there is one condition which may greatly influence the use of electric drive, namely, that its adoption takes the building of machinery away from shipbuilders. "Shipbuilders," he says, "have frequently discriminated against it in making ship prices, and this has been the main cause of its delay. It is hoped that the performances of the *California* and other large ships now building will do much to overcome this impediment." To which we would add, we wonder if this discrimination is in any way responsible for the apparent lack of support for the electric drive which is manifested by shipowners in this country.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Private Automatic Telephone Exchange.

The accompanying illustration (fig. 1) shows a compact private automatic telephone exchange for inter-departmental communication in offices, works, institutions, hospitals, clubs, &c.; designed for a maximum of 10 individual lines, it permits of two simultaneous conversations being carried on. The Strowger components are identical with those supplied to the British Post Office and other administrations

Fig. 1.—A Private Automatic Exchange.

for public service, and the equipment incorporates a vibratory ringer and rectifier for charging the battery from a.c. supply mains, or the equivalent apparatus should the supply be d.c. Trickle charging being the principle adopted, a small-capacity battery suffices, and provision is made for the protection of the equipment against excess voltage. With the exception of the battery, this make of small exchange is entirely self-contained: the overall dimensions are, height 1 ft. 9 in., width 1 ft. 9 in., depth 8 in., and the weight is 86 lb. Provided access can be obtained for occasional inspection or adjustment, the exchange can be located in a convenient cupboard, or on a shelf, or stand. Only two line wires are required between each telephone and the switchboard, which is fitted with screw terminals for convenience in wiring. The AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Milton Road, Edge Lane, Liverpool, is the maker of the outfit.

A New Electric Cooker.

The range of household electric appliances of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has just

Fig. 2.—A New "Magnet" Cooker.

been augmented by a cooker which has been specially designed to meet the requirements of small families and for use in bungalows, flats, and so on. It has a very neat appearance, is sturdily built from sound material and is adequately lagged. The overall dimensions of the cooker are: 33 in. high, 24 in. wide, and 21 in. deep, and, as the accompanying illustration, fig. 2, shows, the oven is raised on four legs to a height which obviates undue stooping. The internal dimensions of the oven are 12 in. by 13 in. by 12 in. All six faces are vitreous enamelled, and the shelf runners are removable so as to facilitate cleaning. There are three shelves provided, together with an oven pan. The oven loading is 1,400 W. The hob is fitted with one circular 8-in. and one circular 6-in. hot plates of the totally-enclosed pattern. The loading of the 8-in. plate is 1,600 W and that of the 6-in. plate is 1,000 W. The oven and both the hotplates are controlled by three-heat reciprocating switches, and each circuit is separately fused. A white enamelled drip pan, withdrawable from the side of the cooker, is provided to catch any liquid which may accidentally fall on or around the hotplates. The cooker is arranged for all standard voltages.

The "Willesden-Utility" Relay.

During the past two years we have published several articles on the subject of levelling-up the load factor of private consumers with the aid of thermal-storage water heaters, which have the great advantage that, whilst providing an indispensable household service, they can be switched off at pleasure for short periods, to enable other electrical appliances to be switched on without affecting the maximum demand. As we have shown, such methods have been extensively adopted on the Continent, and the subject is of great interest to all who are concerned with the domestic load, whether as suppliers, consumers, or contractors; no other plan offers greater prospects of reducing the cost of electricity.

Mr. A. W. Blake, electrical engineer to the Willesden Urban District Council, and one of his assistants, Mr. Spark, have developed and patented a system of constant-load supply of this kind, for which ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10, are the sole licensees and manufacturers. It involves the use of a special "twin relay,"

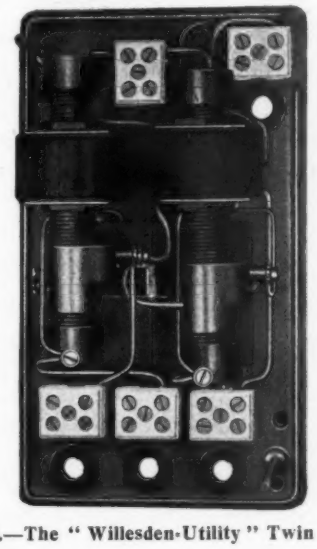


Fig. 3.—The "Willesden-Utility" Twin Relay.

illustrated in fig. 3, and a main current limiter. On this system a predetermined current passes through a 24-hour electric water-heater, and when the consumer uses his lamps sections of the water-heating elements are successively and automatically "cut out" step by step as the lighting load increases. Inversely, as soon as lamps are switched off, the relay automatically "cuts in" the water-heating elements previously "cut out," step by step. By this means the small consumer provides a continuous 24-hour load, with a load factor of 100 per cent. The water heater is preferably provided with three heating coils, one of which is always left in circuit, and the other two are cut out or in automatically by means of the twin relay as required. The twin relay works on the well-known "Utility" system, in which a plunger floats in mercury, and a contact is "broken" or "made" in a hermetically sealed tube. Each of the two relay units is energised by two separate coils, one of which, the "auxiliary" coil, is in series with the third section of water-heating resistance (and is never cut out); the other coil, the "operating" coil, is in series with the lighting circuit. In the case of the first relay unit the operating coil is arranged to cut out one heating resistance as soon as a certain amount

of lighting current is switched on. In the case of the second relay unit, the operating coil is arranged to cut out the second heating resistance, as soon as the lighting current attains any desired strength.

The adjustments are simple, and the instruments have passed the test of time, as identical combinations are used in "Utility" current limiters which have been on the market for eight years. It is stated that the "Willesden-Utility" relay operates with a very small current variation, such as a 20-watt lamp. An approximately constant load is provided continuously, and the supply need not be metered if a current limiter is employed to control the maximum current.

Correspondence.

***Correspondents should forward their communications* as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Wood as an Insulator.

Further particulars are given below in reply to the questions asked in the current issue of the ELECTRICAL REVIEW.

Brass plates or terminals mounted on teak provide a very useful means of terminating multiple telephone and similar cables. Between the terminals are placed disconnecting links for the purpose of testing, each side of the break. Wrong impressions of the condition of the cables have been created by the fact of the varying insulation values between the terminals to which the various wires are connected.

All tests of this character must, of course, include everything to which any particular wire is attached, and, in this case, low results were brought about by the wood and not by the cable, the tests for which the device is intended.

Teak which we had had in stock well over five years was used, and appeared to be thoroughly dry, as it had been under cover for that period, but had not been dried by methods other than the natural one. Wood of various grains and colours has been tried, and all are equally inconsistent. A piece may have very good qualities, and two feet away may be equally bad.

Plates placed 1 in. apart show no appreciable insulation differences across or along the grain of the wood. It is also found that by attaching the plates by means of bolts through the wood, the insulation values are reduced, presumably owing to pressure.

Two nails knocked into a sample piece about 1 in. apart show low insulation values, but there is an appreciable rise in a few minutes' time, presumably caused by the dispersal of the local compression.

The desire is for some treatment which will give uniform insulation values which will also be as stable as the wood is in many other respects.

E. M.

May 31st, 1928.

Trade Union Interference.

One does not wish to prolong the discussion on "Trade Union Interference," but the assertions in the letter by "The Writer of the Article" cannot be allowed to pass unchallenged.

In the first place, there was no question of promotion to a higher grade involved. The point at issue was with regard to the appropriate grade for the duties which were being carried out. The District Joint Board did not deal with the experience of the employé concerned; it only knew that the employé had filled the position with apparent satisfaction for over 3½ years, and, according to the evidence, no complaints regarding his suitability for the position had been made prior to the claim having been advanced on his behalf. If a man is employed in a position for 3½ years, it cannot be legitimately argued that he is unsuitable when a claim for the proper grade or remuneration is submitted. The "Writer of the Article" has no justification for the assertion that the mains assistant had not had sufficient experience, seeing that the question was not considered. Further, to say that the finding of the Board was "that an unsuitable man should be promoted" is a gross distortion of the decision. It said nothing about the man, but dealt entirely with the position, and there is no warrant either in the E.P.E.A. Journal or anywhere else, for making such an unfair aspersion on the employé, or an inversion of the decision.

W. Arthur Jones,

General Secretary, ELECTRICAL POWER ENGINEERS' ASSOCIATION.

London, *June 4th*, 1928.

The Electrical Trades Benevolent Institution.

As we are now entering on a new year of activity which it is hoped will eclipse all previous records, it must be a matter of interest to the industry to know the names of those who will be responsible for the activities of this Institution during the ensuing year.

The Council which was elected at our recent annual general meeting has now elected Mr. L. G. Sloan, J.P., as President of the Institution for this year, and Mr. Sloan has very kindly consented to accept this office and to preside at our annual festival dinner, which will be held in November next.

Mr. Sloan's connection with the industry dates back before 1899, in which year he founded the Sloan Electrical Co., Ltd.; he still retains his interest in this firm, and is also a director of Philips Lamps, Ltd., and Mullard's Wireless Service Co., Ltd. Mr. Sloan is also a past-president of the Rotary Club of London.

The Council has elected the following members to form the Executive Committee for this period: Messrs. J. Y. Fletcher, A. G. Beaver, Justus Eck, E. A. Gatehouse, R. W. Hughman, E. F. Johnson, S. D. White, W. B. Esson, J. M. Sim, L. C. Penwill, E. E. Sharp, and J. N. Stephens. This Committee, although governed by the main Council, is, of course, responsible for the actual detailed work of the Institution.

Electrical Trades Benevolent Institution,

(J. T. KEEPING, *Secretary*.)

9, Southampton Street,
London, W.C.1.

The Registration of Contractors.

I have been greatly interested to read the articles and correspondence in your valuable paper relating to registration of electrical contractors. It is suggested in the articles and correspondence that the E.C.A. should run the Register of contractors.

I may say, as President of the E.C.A., that my Council does not agree with this view, and that from experience I am of the opinion that the Register is answering a very useful purpose.

W. A. Shaw,

President, ELECTRICAL CONTRACTORS' ASSOCIATION (INCORP.).

London, *May 30th*, 1928.

Contracts of Service.

There is a statement in the article by Mr. W. Eric Jackson, LL.B., on "Contracts of Service" in your issue of May 25th which, in my opinion, requires a certain amount of qualification.

I do not think it is quite correct to say that "by the Acts of Parliament dealing with the matter an employé who gets workmen's compensation is not entitled to his ordinary wages." As far as I know, there is nothing in the Workmen's Compensation Acts to prevent an employé receiving his ordinary wages during a period equivalent to the amount of notice to which he is entitled under his contract of service. It has been settled that the relation of master and servant is not determined merely because the employé is temporarily absent from work and in receipt of compensation for incapacity under the Workmen's Compensation Acts, and thus it would seem to follow that during the period of notice he is entitled to his ordinary wages. Thus, if an employé's contract of service is terminable by one month's notice, he may claim his wages during that period notwithstanding the fact that the employer is liable to pay compensation.

A case has recently arisen in regard to an engineer in the employ of a municipal Corporation who was absent from duty owing to incapacity for a period of ten days, and the Corporation agreed, after the point had been taken up with them, that the employé was entitled to his full salary during that period, notwithstanding the fact that he was entitled to compensation under the Acts.

The amount of compensation was, of course, merged in, and was not additional to, the salary.

J. W. Thomas.

Manchester, *May 26th*, 1928.

I quite agree with Mr. J. W. Thomas and I am pleased to see that in a way he agrees with me. An employé cannot claim his ordinary wages in full plus compensation. If he gets wages in full then his employer need pay him nothing more. If wages come to an end on disability then compensation is payable.

My article was not meant to be a legal treatise but only a plain statement of the law for practical men.

All I wished to point out was that workmen's compensation is a compensation for loss of wages, not a compensation for pain and suffering, and that if he is compensated in one way he cannot be compensated at the same time in another.

W. E. Jackson.

London, *June 4th*, 1928.

Developments in Current-Transformer Design.

I am interested to learn from Mr. Clough that the method of fractional-turn correction for bar-primary current transformers, described in my article of May 11th, is covered by patent.

This method constitutes a very simple and effective way of overcoming certain of the difficulties of bar-primary current-transformer correction, especially when Stalloy iron is used for the cores.

The introduction of such new alloys as Mumetal, the losses of which are so much lower than those of Stalloy, is fortu-

nately tending to eliminate the use of such devices, which, while being quite satisfactory, constitute a complication which could well be avoided.

G. L. E. Metz.

Manchester, *June 4th*, 1928.

Wanted—A New Word.

With reference to Mr. R. O. Kapp's letter, I suggest that the term "Volts × amperes × sin ϕ ÷ 1,000" should be called "Kilosinehours."

This term immediately implies that true kilowatt-hours, as usually called, are actually kilowatt-cosine hours.

Robt. Hornby.

London, *June 1st*, 1928.

[The last three words are apparently a slip, intended to read "kilovoltampere-cosine hours."—EDS. ELEC. REV.]

With reference to your leaderette as to a suitable name for a B.O.T. unit, I suggest "Vampour."

Fred. M. Lea.

Birmingham, *June 1st*, 1928.

With reference to Mr. Reginald O. Kapp's request for a suitable word for the expression :—

Volts × amperes × sin ϕ

I should suggest the word "Sinwatt," and for the term

Volts × amperes × sin ϕ ÷ 1,000

the word "Kilosin," both being in the singular.

Both words bear some resemblance to the quantity to be expressed, and the use of the word "Kilosin" would be more euphonious, and hence preferable to "Kilosinwatt" when using thousands of these units. It would thus lend itself to "Kilosin-hours" euphoniously, when the time was also under consideration.

Apart from the difficulty of expressing the quantity, students often find it difficult to appreciate its mathematical significance, without additional complications such as your correspondent suggests.

S. B. Jackson.

London, *June 2nd*, 1928.

Your correspondent Mr. Reginald O. Kapp calls for words which will be more manageable than those at present in use in relation to a.c. circuits.

While giving consideration to the revision of such terms, would it not be of advantage to reduce them to expressions which, although perhaps not strictly accurate when viewed in a purely technical aspect, yet would be such that they would be readily acceptable to those whose interest in electrical matters is confined more to commercial considerations?

"Power Factor" is, in many instances, closely related to financial interests; and yet such a term usually conveys something very vague and indefinite to the minds of those who control the purse-strings of electrical undertakings.

May I therefore suggest that the kVA and kW values of an a.c. circuit be referred to as the "Gross Power" and "Net Power" respectively?

Leslie G. Toplis.

Perth, *June 4th*, 1928.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1926.

28,419. "Alternating-current commutator motors." British Thomson-Houston Co., Ltd., and H. Dreghorn. November 11th, 1926. (290,311.)

1927.

2,859. "Alternating-current electric motors." British Thomson-Houston Co., Ltd., and H. Dreghorn. February 1st, 1927. (290,329.)

3,547. "Signalising device for the transmission and reception of signals even in foggy weather or at night between two vessels or between a vessel and land." A. Della Riccia. February 8th, 1927. (290,333.)

3,642. "Electric motor with integral speed-reducing gear." F. F. H. Schroeder. February 9th, 1927. (290,336.)

3,727. "Sound-reproducing apparatus." C. M. de C. de la Bourdonnais. February 9th, 1927. (290,344.)

3,804. "Systems of electric distribution." British Thomson-Houston Co., Ltd. February 11th, 1926. (265,979.)

3,808. "Radio apparatus." British Thomson-Houston Co., Ltd., H. W. H. Warren, and T. H. Kinman. February 10th, 1927. (290,350.)

3,809. "Thermionic amplifying devices." W. S. Smith and N. W. McLachlan. February 10th, 1927. (290,351.)

3,842. "Electron discharge devices." J. R. Sinclair. February 11th, 1927. (Cognate application 33,454/27.) (290,355.)

3,979. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd., E. P. G. Wright, A. H. Cameron, and A. J. Chanter. February 12th, 1927 (290,362.)

4,096. "Light sensitive cells and circuit arrangements therefor." G. M. Wright. February 14th, 1927. (290,367.)

4,444. "Mechanically-operated electric switches and the like." Electric Control, Ltd., and O. O. F. Bergmann. February 17th, 1927. (290,378.)

4,598. "Dielectric product and process for manufacturing same." A. Mouillefarine. February 18th, 1926. (266,370.)

4,647. "Electrical gasfilled discharge tubes." F. Meyer, H. J. Spanner, and E. Herfurt. August 6th, 1926. (275,552.)

5,368. "Thermally-actuated electric lamp socket." L. Ludwig. February 25th, 1927. (290,385.)

5,504. "Horns for wireless loud-speakers and the like." A. Stanley. February 28th, 1927. (290,387.)

5,991. "Electro-therapeutic apparatus." Dr. E. A. P. D'A. Callery. March 3rd, 1926. (267,134.)

6,603. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. March 9th, 1927. (290,396.)

6,931. "Electrical heating apparatus." A. W. Kimber. March 12th, 1927. (290,398.)

7,296. "Insulated electric conductors and terminals." Siemens Bros. and Co., Ltd., E. A. Beavis, and H. G. Wood. March 16th, 1927. (290,401.)

7,432. "Manufacture of carbons for use as anodes of electric cells." Compagnie Lorraine de Charbons Lampes et Appareillages Electriques. February 16th, 1927. (285,415.)

7,504. "Alternating-current mercury-vapour apparatus." F. Reynolds and A. L. Lees. March 18th, 1927. (290,403.)

8,044. "Electrical terminals." Siemens Bros & Co.. Ltd. and C. R. Riber. March 23rd, 1927. (290,407.)

8,516. "Joints for electric cables." W. E. Thorn. March 28th, 1927. (290,412.)

8,645. "Electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. March 29th, 1927. (290,414.)

9,919. "Speed reducing devices for control of condensers, variometers, and the like of radio apparatus." A. Bonnefont. April 12th, 1926. (269,211.)

12,014. "Electrical instruments for measuring, indicating, and other purposes." W. M. Thornton. May 5th, 1927. (290,436.)

12,111. "Gasfilled incandescent cathode discharge tubes." S. G. S. Dicker (Namlooze Vennootschap Philips' Gloeilampenfabrieken). May 5th, 1927. (290,437.)

13,803. "Electrical measuring instruments of the movable-coil type." E. C. R. Marks (Weston Electrical Instrument Corporation). May 23rd, 1927. (290,445.)

15,312. "Method of, and means for, the correction of temperature errors in electric meters." Sangamo Electric Co. November 12th, 1926. (280,494.)

17,089. "Quick-action electric switches." A. J. Veall. July 22nd, 1926. (274,836.)

17,308. "High-frequency induction furnaces." I. Rennerfelt. June 29th, 1927. (290,460.)

19,148. "Circuit interrupters" British Thomson-Houston Co., Ltd. July 23rd, 1926. (274,868.)

19,281. "Ignition magnetos." M-L Magneto Syndicate, Ltd, and F. J. Marlow. July 20th, 1927. (290,470.)

20,771. "Electric control switches for high-tension cables." F. Berg. August 6th, 1927. (290,475.)

22,266. "Electric motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 24th, 1927. (290,479.)

22,524. "Electrically-heated machines for the brewing of tea, coffee, and the like beverages." Jackson Boilers, Ltd., and A. G. Barrow. August 27th, 1927. (290,481.)

23,031. "Electrical condensers." Telegraph Condenser Co., Ltd., and S. G. Brown. September 1st, 1927. (290,485.)

23,034. "Arc-lamp regulators." C. Delcommune. September 1st, 1927. (290,486.)

23,113. "Thermal time-lag relay." F. Schiele (trading as Schiele and Bruchsaler Industrie-Konzern). September 2nd, 1926. (Addition to 241,587.) (277,021.)

24,221. "Thermo-electric pyrometers." J. L. Orchard and Cambridge Instrument Co., Ltd. September 14th, 1927. (290,493.)

30,301. "Electric heating elements." J. H. Allen. November 11th, 1927. (290,514.)

31,269. "Electric lamps for illuminating the mouth." R. Widermann. February 15th, 1927. (285,400.)

33,933. "Electric incandescent lamps." General Electric Co., Ltd. January 17th, 1927. (283,848.)

35,221. "Electric lighting installations having generators operating at variable speed." O. Akerman and Allmanna Svenska Elektriska Aktiebolaget. December 29th 1927. (290,534.)

1928.

1,351. "Piezo-electric devices." Marconi's Wireless Telegraph Co., Ltd. January 15th, 1927 (283,596.)

1,893. "Radio high-tension batteries." R. Sachs Ges. December 1st, 1927. (290,539.)

4,131. "Shielding systems for electric discharge devices." British Thomson-Houston Co., Ltd. February 9th, 1927. (285,044.)

5,132. "Storage batteries." M. Espagnent. February 18th, 1927. (285,701).

7,384. "Electrode structures for electron-discharge devices." British Thomson-Houston Co., Ltd. March 12th, 1927. (287,055.)

8,353. "Electrolytic disposition of tin from alkaline solutions." Siemens and Halske Akt.-Ges. October 13th, 1927. (Addition to 286,673.) (290,552.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 30th :—

Key (design only). No. 491,102. Class 6. Electric carpet sweeping machines.—Selfridge & Co., Ltd.

Girco, No. 488,927, and Ircol, No. 488,928. Class 8. Insulated electric cables.—Greengate & Irwell Rubber Co., Ltd.

Maranex. No. 488,944. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd.

Celestophone. No. 489,737. Class 8. Radio-telephonic apparatus, &c.—C. Freach, 29, High Street, Hampton Wick, Middlesex.

Widia. No. 489,790. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Fried Krupp Gesellschaft, Essen, Germany. (British representatives: Brewer & Son, 33, Chancery Lane, W.C.2.)

Chasseral. No. 490,114. Class 8. Electricity meters.—Société de la Fabrique des Longines, Francellon & Co., St. Imier, Switzerland. (British representatives: Harris & Mills, 34-35, High Holborn, W.C.1.)

CORRECTION.—The trade-mark entered by W. T. Henley's Telegraph Works Co., Ltd., recently is "Henlite," and not "Henlita" as stated in our issue of May 25th.

Electrical Precipitation.

In a paper dealing with various methods employed in the cleaning of blast-furnace gas, read recently before the Iron and Steel Institute, the author, Mr. V. Harbord, concludes that the cost of operating electrostatic plant is less than that of most other types of plant, but that the average dust content in the cleaned gas is higher than with disintegrator washers. The sensible heat is retained, but the handling of the dry dust has some disadvantages. Improvements are still being made with this type of apparatus, which must be regarded as being still more or less in its infancy, and it will probably have a very big field in the future. The capital cost is high.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Nurses' home and new ward at City Hospital (£46,000); city architect.

AIRDRIE.—School (£17,000), for Education Authority of Lanark; clerk, Hamilton.

BEDWAS.—Benzol and coal distillation works (£300,000); S. Instone & Co., Ltd.

BEDWELLTY.—Additional 128 houses, Blackwood, for the U.D.C.; Dan Price, surveyor.

BELPER.—Additions to Palace Theatre; E. Bryan Dean, architect, Market Chambers, Mansfield (returnable deposit of £1 1s.).

BURSLEM.—Drill hall and staff quarters, for Staffs. Territorial Army Association; Stephen Heath & Son, builders, Newcastle-under-Lyme. Printing works, Sandbach Road; J. Knight.

CHELMSFORD.—Houses (32), Writtle, for the R.D.C.; F. J. & A. A. Lowe, builders. Library and museum, Duke Street; borough librarian.

CHICHESTER.—Nurses' home, Royal West Sussex Hospital; Whitehead & Whitehead, architects, 18, South Street.

CHINGFORD.—Houses (20), with electric lighting work, for the U.D.C.; Friend & Bradshaw, builders, Newcastle-on-Tyne. School (£14,094), for Essex E.C.; J. Stuart, county architect, Chelmsford.

DUNSTABLE.—Factory extensions; Garrard Gear Co.

FIFESHIRE.—Extensions at Inverkeithing Paper Mill; the manager.

GLASGOW.—Students' union at University (£60,000); J. Arthur & McNaughton, architects. Shops and houses, Elizabeth Drive and Paisley Road; Kinning Park Co-operative Society, Ltd.

HALIFAX.—Housing scheme (90), Moorend Road, for the T.C.; borough surveyor.

HARWORTH BIRCOTES.—School (£10,200); Notts. Education Committee.

HATFIELD (HERTS.).—Additional 60 houses, for the R.D.C.; H. T. Sidwell, surveyor.

HEREFORD.—Bazaar premises, for Marks & Spencer, Ltd., London; Bettington & Sons, architects; Bovis, Ltd., builders, Paddington, London.

HORDEN (CO. DURHAM).—Kinema, Cotsford Lane, for Horden Theatres, Ltd.

HORSHAM.—Store, offices, workshops, and additions to main engine room, electricity works, for the U.D.C.; C. G. Atkinson, surveyor (returnable deposit of £2 2s.).

HULL.—Re-housing scheme (559 flats), for the T.C.; borough engineer.

INVERNESS.—Theatre block, X-ray rooms, &c., at Northern Infirmary (£8,050); the medical superintendent.

IRISH FREE STATE (DUBLIN).—Extensions to Sir Patrick Dun's Hospital, for the Governors.

KENDAL.—Extensions to Westmorland Hospital (£14,000); J. F. Curwen Son, architects, Highgate.

KIDDERMINSTER.—Factory, New Road, for E. A. Broome and Sons.

KINGSTON-ON-THAMES.—Additional 60 houses, for the T.C.; borough surveyor.

LANARKSHIRE.—Housing scheme for District of the Middle Ward (electric lighting); P. C. Smith, Housing and Town Planning Department, District Offices, Hamilton.

LEIGH (LANCS.).—Roman Catholic church (£20,000); priest-in-charge.

LIVERPOOL (AINTREE).—Tin plate factory, for T. R. Gee and Sons.

LONDON (ILFORD, E.).—120 houses, Tomswood estate; borough engineer. Alterations, Ilford, Ltd., works, Roden Street; Hammond & Miles, Ltd.

(HORNSEY, N.).—62 houses, Queenswood Road; Smerdon Bros.

(NEW CROSS, S.E.).—Rebuilding Kender Street schools (£15,965), for the London E.C.

(WALWORTH, S.E.).—Maternity home, Walworth Road; Southwark borough engineer.

(WIMBLEDON, S.W.).—72 houses, Durnsford Road; Unit Construction Co., Ltd. Additions, Wimbledon Hospital, Thurstan Road; R. J. & J. S. Thomson. Billiard hall, Haydons Road; E. G. Cole.

LUTON.—Small-pox hospital, for the T.C.; J. W. Tomlinson, borough engineer (returnable deposit of £1 1s.). Concert hall extensions, for the Working Men's Club and Institute; R. M. Godfrey, architect, Prudential Chambers (returnable deposit of £1 1s.).

MANCHESTER.—Extension of School of Technology, Whitworth Street; Bradshaw, Gass & Hope, architects, Silverwell Street, Bolton. Additions, Ardwick Picture Theatre, Hyde Road; licencee.

MANSFIELD.—Conversion of premises into nurses' home, for Guardians (£3,066); R. Moore & Son, builders.

MARCH.—Theatre, Dart Hill Road; March Amusements, Ltd.

MARGATE.—School (£15,000), for the borough E.C.; Foster and Barber, architects.

MIDDLEWICH.—Housing scheme (48), for the U.D.C.; F. W. Stocks, surveyor (returnable deposit of £2 2s.).

PETERBOROUGH.—Housing scheme (54), Mayor's Walk estate, for the T.C.; W. H. A. Court, city engineer (returnable deposit of £3 3s.). Church and schools, King's Dyke, for the United Methodist trustees; W. Fovargue and Son, architects, The Causeway, March (returnable deposit of £2 2s.).

PLYMOUTH.—Mental hospital; deputy borough architect. Institute, Mount Gold; A. T. Pike, secretary, governors of Lady Astor Housing Trust, 3, Gray's Inn Place, London, W.C. (returnable deposit of £2 2s.).

PONTEFRACT.—Reconstruction of premises, Corn Market, for the proprietors of the *Pontefract and Castleford Express;* Hustler & Taylor, architects.

REDCAR.—Theatre, ballroom, café, &c.; T. Thompson, Middlesbrough.

ROWLEY REGIS.—Additional 78 houses, for the U.D.C.; W. F. Edwards, architect.

SEDGFIELD.—300 houses, for the R.D.C.; surveyor.

ST. HELENS.—Electric light installation, open air school, for the borough E.C.; Biram & Fletcher, architects, George Street. "Capitol" cinema (£45,000), for a local syndicate; Gray & Evans, architects, Liverpool.

SHOTTS.—Housing scheme (44), with electrical work, for Lanarkshire C.C.; P. C. Smith, district offices, Hamilton.

SIDMOUTH.—Extensions to Victoria Hospital (£10,000); secretary.

SOLIHULL.—Girls' secondary school; Warwickshire E.C.

SOUTHPORT.—Motor-'bus garage, Canning Road (deposit £1 1s.); A. E. Jackson, borough engineer.

SLOUGH.—Houses (48), Baylis Road, for Carlisle (Builders), Ltd.

SOUTH AFRICA (CAPE TOWN). — Municipal buildings (£185,000). Housing scheme (£600,000). Completion of Art Gallery (£25,000); D. E. Lloyd-Davies, city engineer.

STAFFORD.—Extensions, Groundslow Sanatorium (£9,400), for Staffs., Wolverhampton and Dudley Joint Committee for Tuberculosis; clerk, Stafford.

STIRLING.—Block of buildings, including billiard hall, for Key Estates, Ltd., 112, Albion Street, Leeds. Works for coal distillation at Glenboig, for Bussey Coal Distillation Co. of U.S.A.; the manager.

STOCKTON-ON-TEES.—Works for the manufacture of homogeneous lead lining, for Ashmore, Benson, Pease & Co.

STOKE-ON-TRENT.—Hospital accommodation; Stoke and Wolstanton Guardians. Alterations and additions, South Wolfe Street and Campbell Place; F. W. Woolworth and Co., Ltd. Alterations, Oldcott Road, Goldenhill; Potteries Electric Traction, Ltd.

STOURBRIDGE.—Cinema (£21,000), for the Stourbridge Central Theatre, Ltd.; Webb & Gray, architects, Dudley.

THIRSK.—Extensions, Lambert Memorial Hospital; Thomas Stokes, architect.

TORQUAY.—Extensions, Hotel Metropole, Belgrave Road; F. E. Hall.

THORPE HESLEY.—School (£13,760), for West Riding E.C.; George Saul & Sons, Ltd., builders, Rotherham.

TYNEMOUTH.—Thirty-two houses, St. George's Estate; H. D. Burton, Ltd. Development, Kirton Park Estate; A. K. Tasker.

WARMINSTER.—Cottage hospital (£10,000); secretary.

WALTHAM-ON-THE-WOLDS.—Hunting box (electric lighting and heating), for the Hon. E. Greenall; W. T. Benslyn, architect, Essay Road, Birmingham.

WATH-ON-DEARNE.—Middle school at Brampton Bierlow, for the Educational Foundation of George Ellis (1711); C. F. Moxon, 3, Regent Street, Barnsley (£2 2s.).

WELWYN GARDEN CITY.—Bank (£9,383), for Barclay's Bank, Ltd.; L. de Soissons and A. W. Kenyon, architects, Blue Ball Yard, St. James' Street, S.W.; Welwyn Builders, Ltd., contractors.

WILLITON (SOMERSET).—Housing scheme (56), for the R.D.C.; surveyor.

WORTHING.—Church, Broadwater (£7,500); Wesleyan trustees.

YEOVIL.—Extensive additions to engineering works and workmen's houses, for Petters, Ltd.

YORK.—112 houses, Nursaws estate; city engineer. Blacksmith's shop, stores, &c., Haxby Road; Rowntree and Co., Ltd. Extensions to fever hospital (£26,360), for the T.C.; F. W. Spurr, city engineer.